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UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
AT SAN FRANCISCO

FOOD & WATER WATCH, et al.,

Plaintiffs,

vs.

U.S. ENVIRONMENTAL PROTECTION
AGENCY, et al.

Defendants.

Civ. No. 17-CV-02162-EMC

**DECLARATION OF
HOWARD HU, MD, MPH, ScD**

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I, Howard Hu, MD, MPH, ScD, declare that:

1. I am a physician-scientist trained in internal medicine, occupational/environmental medicine, epidemiology and general public health who has held leadership positions in science and academia for over 2 decades.

2. I am also the Principal Investigator of ongoing research that is examining the impact of early-life exposures to fluoride on neurobehavioral development in the offspring participating in the Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) project.

I. SUMMARY OF QUALIFICATIONS

3. A complete summary of my qualifications and publications can be found in my Curriculum Vitae, which has been marked as Plaintiffs' Exhibit 5 and attached herein.

4. As relevant to my testimony here, I am an epidemiologist with decades of research experience investigating the impact of environmental toxicants on human health. In 1990, I received a Doctor of Science degree in Epidemiology from the Harvard School of Public Health, and since that time have taught epidemiology at Harvard, University of Michigan, and University of Toronto, where I served as Dean of the School of Public Health.

5. I hold editorial positions on leading environmental and occupational health journals, including the *American Journal of Industrial Medicine*, *Current Environmental Health Reports* and *Environmental Health Perspectives*, and serve as a peer reviewer for the *American Journal of Epidemiology*, *Epidemiology*, *Journal of the American Medical Association*, *Lancet*, *New England Journal of Medicine*, and *Pediatrics*, amongst others.

6. My own epidemiological research has resulted in hundreds of peer-reviewed publications in leading scientific journals. For the past 29 years, this research has been continuously funded by the National Institutes of Health (NIH) through a number of competitive R01 grants.

1 7. The Environmental Protection Agency (EPA) has funded several of my epidemiological
2 studies, including a \$7.8 million research grant to study the effects of metals mixtures on children's
3 health. I have also served as an expert advisor to the EPA, including as a member of EPA's Science
4 Advisory Board on Relative Risk Reduction Strategies and as an expert reviewer of EPA's recent draft
5 report on the concentration-response functions between lead exposure and cardiovascular disease.

6 8. In 1993, I co-founded the ELEMENT research project, a pregnancy and birth cohort that
7 has been funded by both the EPA and NIH. Since its inception, ELEMENT has evolved into a highly
8 successful, award-winning project involving collaborators at the University of Michigan, Harvard, and
9 other academic institutions in the U.S., Canada, and Mexico.

10 9. Through the ELEMENT cohort, we have studied how prenatal exposure to environmental
11 toxicants—including lead, mercury, and fluoride—affect children's health, including their
12 neurodevelopment. Thus far, the ELEMENT cohort has generated over 80 high-impact publications and
13 provided evidence contributing towards environmental health policies around the world, including the
14 EPA's national air standard for lead and the CDC's "Guidelines for the Identification and Management
15 of Lead Exposure in Pregnant and Lactating Women."

16 10. In 2012, following the National Research Council's (NRC) call for more research to
17 investigate the neurobehavioral risks of fluoride exposure, the team I lead successfully competed for a
18 peer-reviewed NIH RO1 grant to study the neurodevelopmental effects of pre- and post-natal fluoride
19 exposures. This research was funded with an understanding that it would provide a major contribution to
20 fluoride risk assessment and policy decision-making on the neurotoxicity concerns identified by the
21 NRC.

22 11. To date, my team has published five peer-reviewed studies on fluoride, including two
23 prospective studies on fluoride and neurodevelopment that were published in the world's two most
24

1 prominent environmental health journals: *Environmental Health Perspectives* and *Environment*
2 *International* (Bashash 2017, Bashash 2018, Cantoral 2019, Liu 2019, Thomas 2016). As with our own
3 research, the journal *Environmental Health Perspectives* is funded by the NIH.

4 **II. SUMMARY OF OPINIONS**

5 12. The ELEMENT prospective cohort studies of fluoride's neurodevelopmental effects are
6 methodologically rigorous studies that provide scientifically reliable and robust results.

7 13. The results of the ELEMENT prospective cohort studies are consistent with and support
8 the conclusion that fluoride is a developmental neurotoxicant at levels of exposure seen in the general
9 population in water-fluoridated communities.
10

11 **III. BASIS FOR OPINIONS**

12 **A. The Methodological Strengths of the ELEMENT Studies**

13 14. *Prospective Birth Cohort Study Design*: One of the key strengths of our ELEMENT
14 research is that it has utilized a prospective birth cohort design. Prospective studies (aka longitudinal
15 cohort studies designed at the outset to enable research on the topics of interest and that follow a defined
16 group of individuals) are recognized by epidemiologists as the ideal study design for investigating the
17 impact of environmental toxicants on human health, in part, because the measurement of exposure
18 precedes the development of disease/dysfunction. This is important because it permits greater
19 confidence in the causal relationship of an association since the requirement of temporality is satisfied
20 i.e., the exposure precedes the effect, which, in turn, is one of the components of the Bradford Hill
21 criteria. Where there is suspicion that a chemical may exert a toxic effect *in utero*, a birth cohort study
22 design is critical because it allows an assessment of exposure during the prenatal period.
23

24 15. *Effective Control for Other Factors that Influence IQ*: Our ELEMENT studies have
25 considered and controlled for a large number of factors known to affect neurodevelopment, which
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increases the rigor of the results. First, we excluded women from the study who had characteristics known to affect neurodevelopment, including gestational diabetes, renal disease, hypertension, circulatory diseases, use of illicit drugs, and alcohol consumption. Second, our analyses of fluoride and neurodevelopment controlled for a large number of potential confounders, including maternal age, maternal education, maternal IQ, birth weight, gestational age at time of delivery, sex of child, birth order, maternal smoking, and marital status. Third, we performed sensitivity analyses which controlled for the quality of the child's home environment (i.e., HOME),¹ as well as prenatal lead and mercury exposures.

16. ***Blinded Assessments:*** Our studies employed a "blinded" study design where neither the examiners nor the subjects were aware of the subject's fluoride exposure status at the time of the neurodevelopmental exams. A blinded study design is superior to a non-blinded study because it helps protect against bias, including unconscious bias, in the assessment.

17. ***Individual Biomarkers of Both Prenatal and Postnatal Exposure:*** As cohort studies, our investigations have collected and utilized individual measurements of fluoride exposure, covariates, and the outcomes of interest. Cohort studies with individual measurements of exposure, covariates and outcomes are considered much more robust than studies with group-level metrics (otherwise known as "ecological studies") because the accuracy and precision of individual-level measures are far superior to the estimates of these parameters that are associated with ecological studies. In our studies, we measured prenatal fluoride exposure by testing archived samples of the mother's urine that were collected during pregnancy. Urine fluoride is a well-accepted biomarker of total fluoride exposure. As the EPA has

¹ The HOME Score is a rating that is performed by a research observer who gains permission to enter the home and observe the interactions between the offspring and other family members, as well as other characteristics of the home environment. It is intended to try to capture the ability of the home to enrich a child's educational development and skill development. It is often highly correlated with socio-economic status, but it also has some independent value of its own in determining a child's neurodevelopmental trajectory.

1 recognized, “archives of biological samples from birth cohort studies . . . provide critical information on
2 the prenatal and childhood determinants of adult disease” (EPA-NIEHS 2017, p. 9). The archived urine
3 samples in our studies were tested under the oversight and direction of Dr. Angeles Martinez-Mier, a
4 leading authority on the measurement of fluoride in urine and plasma.

5 18. As I acknowledge and discuss further below, there are some limitations with our urine-
6 based exposure estimates. These limitations, however, do not provide a plausible explanation for the
7 results we have observed as they create *non-differential* imprecision in the exposure variable (in this
8 case, the non-differential exposure misclassification is sometimes referred to as “random” or “classical”
9 measurement error associated with exposure). It is a basic epidemiologic axiom that non-differential
10 errors, such as non-differential exposure misclassification, bias the results towards the null (i.e., no
11 association exists), rather than create spurious associations where none otherwise exist. I discuss this
12 further below.
13

14 19. ***Large Cohort Sizes:*** Our studies have involved a sufficiently large number of mother-
15 offspring pairs to permit statistical analyses that are stable and robust. In our 2017 study (“Bashash
16 2017”), we investigated fluoride’s relationship with intelligence among 299 mother-offspring pairs. This
17 included 287 mother-offspring pairs for the analysis of intelligence at age 4, and 211 mother-offspring
18 pairs for an analysis of intelligence at ages 6-12. In our 2018 study (“Bashash 2018”), we investigated
19 the relationship between fluoride and symptoms of Attention-Deficit Hyperactivity Disorder (ADHD)
20 among a total of 213 mother-offspring pairs, with the ADHD assessment conducted between the ages of
21 6 and 12.
22

23 20. ***Reliable Neurocognitive Tests:*** Our 2017 study on intelligence used validated,
24 standardized neurocognitive tests that were administered by a team of psychologists. For the 4-year old
25 children, we used the McCarthy Scales of Children’s Abilities (MSCA), and focused on the General
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Cognitive Index (GCI) score. For the 6-12 year old children, we used the Spanish version of the Wechsler Abbreviated Scale of Intelligence (WASI)² to assess Full-Scale IQ. All raw scores were standardized for age and sex. The examining psychologists were trained and supervised by an experienced developmental psychologist, and independent testing confirmed a very high correlation (0.99) in the scoring, thus confirming a high degree of inter-examiner reliability.

21. ***Reliable Neurobehavioral Tests:*** Behaviors associated with ADHD were assessed using the Spanish version of the Conners' Rating Scales-Revised (CRS-R)³ and Conners' Continuous Performance Test (CPT-II, 2nd Edition).⁴ All measures of ADHD-behaviors were standardized for age- and sex. Higher T-scores (mean of 50, SD of 10) indicate poorer performance. All psychometric tests were applied under the supervision of an experienced psychologist.

22. ***Appropriate Statistical Analyses that Did Not Assume Linearity:*** We used the same standard statistical analyses for our fluoride studies as we have used for our other ELEMENT studies. These included regression analyses that appropriately adjusted for potential confounders, as well as Generalized Additive Models (GAM) that visualized adjusted associations between fluoride and neurodevelopment for purposes of assessing the linearity of the relationship. We did *not* assume

² The WASI shows strong criterion validity with the full-length Wechsler Intelligence Scale for Children (WISC-III; ages 6-16 yrs), and the Wechsler Adult Intelligence Scale (WAIS; ages 16+ yrs). The correlation coefficient between the Full Scale IQ of the WASI and WISC-III is 0.81 (Wechsler, 1991), and 0.92 between the WASI and the WAIS-III (Wechsler, 1999), indicating a high covariance between the abbreviated and full-length measures of intellectual ability. The WASI is also correlated with another abbreviated IQ test, the Kaufman Brief Intelligence Test ($r = 0.89$), providing evidence for convergent validity (Hays et al., 2002). Finally, the WASI demonstrates excellent internal consistency (reliability=0.976) (based on data from Tables 5.1 and 5.8 of the WASI manual).

³ The CRS-R contains three ADHD scales that correspond with the Diagnostic and Statistical Manual of Mental Disorders – 4th edition (DSM-IV) criteria for ADHD: 1) DSM-IV Inattention Index, 2) DSM-IV Hyperactive-Impulsive Index, and 3) DSM-IV Total Index (inattentive and hyperactive-impulsive behaviors combined). It also examines seven types of behavior problems that were derived through factor analysis, including: Oppositional, Anxious-Shy, Cognitive Problem/Inattention, Hyperactivity, Perfectionism, Psychosomatic, and Social Problems. For our study, we examined the three DSM-IV ADHD scales as our primary outcomes because these scales are intended to screen for ADHD, and are commonly used to study the association between diverse environmental contaminants and ADHD- behavior problems.

⁴ The CPT-II is a computer-administered signal detection paradigm. Using the CPT-II, we measured errors of omission and commission, and hit reaction time (response latency).

linearity in the dose-response relationship. Additionally, we took appropriate steps to eliminate the influence of outliers and influential points.

B. Prenatal Fluoride Exposure Is Associated with Substantial and Significant Adverse Effects on IQ and ADHD-Behaviors in the ELEMENT Cohort

23. In the ELEMENT cohort, we found that prenatal fluoride exposure has a linear, dose-response relationship with reduced IQ among both 4-year old and 6-12 year old children (Bashash 2017).⁵ In our main model that adjusted for potential confounders, we found that each 0.5 mg/L increase in maternal urinary fluoride (which approximates the interquartile range, i.e., the difference between the 25th v. 75th percentile) was significantly associated with a loss of 3.15 GCI points among the 4-year-olds, and a loss of 2.5 IQ points among the 6-to-12 year olds. These are substantial reductions in intelligence that rival the effect sizes associated with lead exposure. As one measure of practical impact developed and published in 2009 by an expert from the Economics Policy Institute, each IQ point lost due to lead exposure was estimated to represent a loss of \$17,815 in present discounted value of lifetime earnings (in 2006 USD) (Gould 2009).

24. Visual assessment of the adjusted associations between fluoride and intelligence confirmed the monotonic, mostly linear nature of the relationships (see Figures A and B). Notably, there was no evidence of a threshold among the 4-year olds, although there was some suggestion of a threshold at approximately 0.8 mg/L among the 6-12 year olds.

⁵ We have subsequently reported an analysis, in abstract form, of neurocognitive outcomes at ages 1 to 3, as measured through the Mental Development Index (Thomas 2018). These results are consistent with the age 4 and age 6-12 analyses in that they show significant adverse associations with maternal urinary fluoride. I do not rely on these results here, however, since they have not yet been published in full

Figure A: Visual Association Between Maternal Urinary Fluoride and Intelligence at Age 4

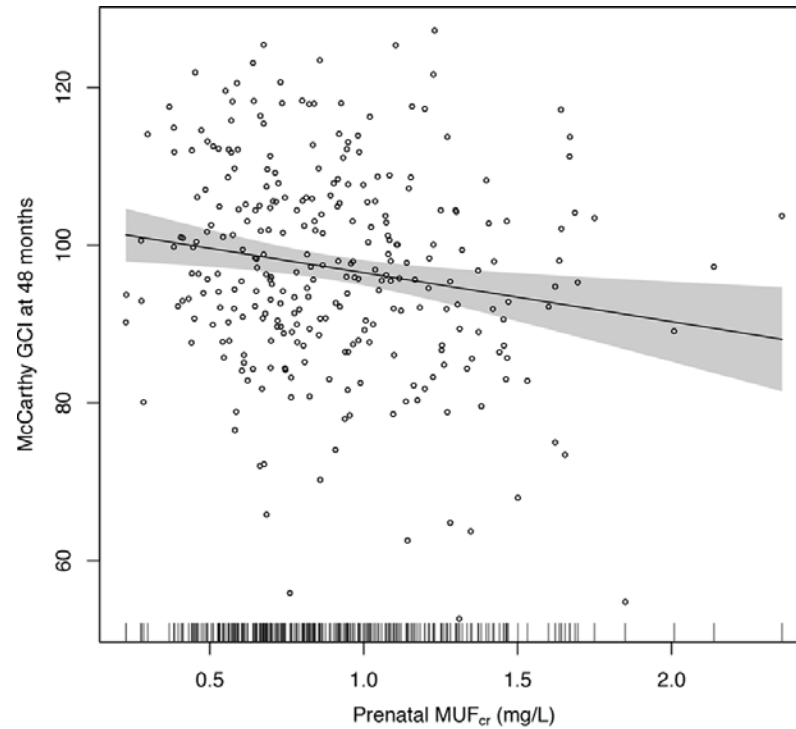
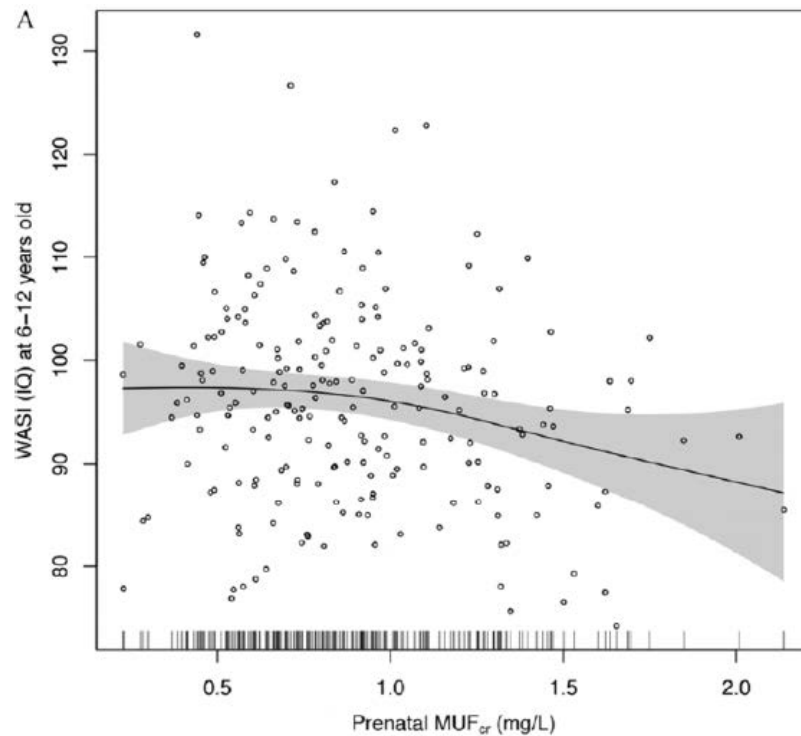


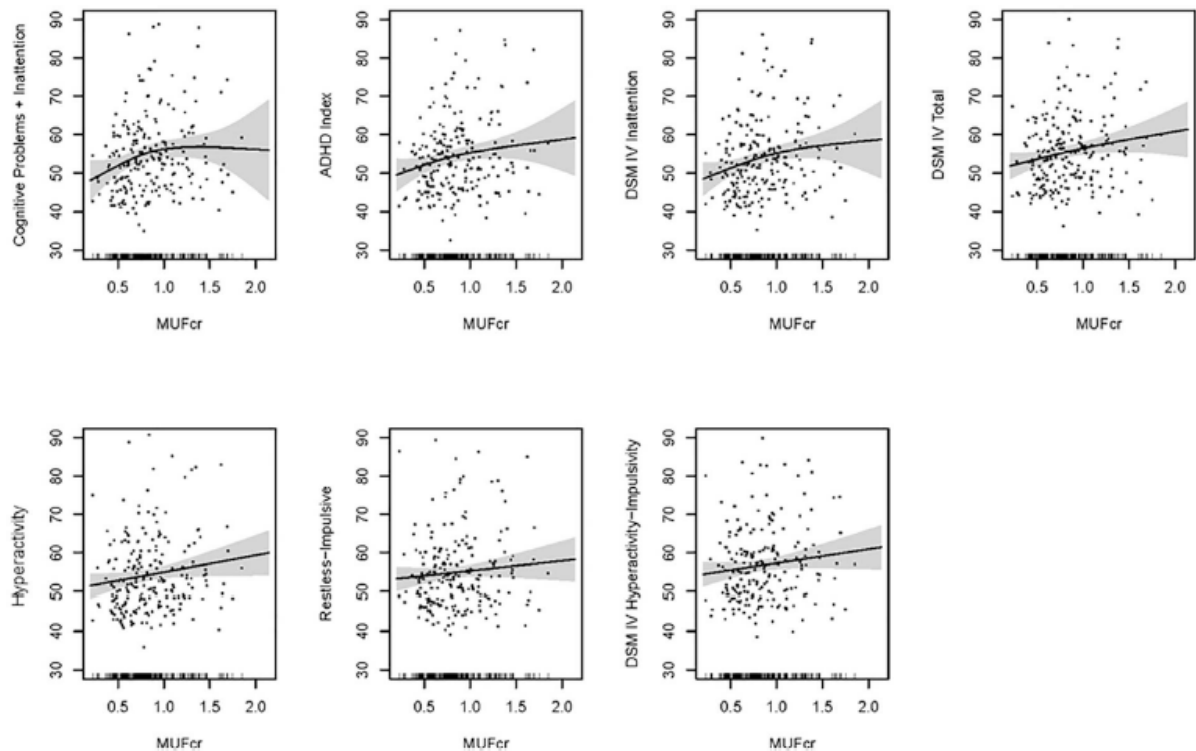
Figure B: Visual Association Between Maternal Urinary Fluoride and Intelligence at Ages 6-12



1 25. In contrast with prenatal exposures, we did not find statistically significant associations
2 between IQ and childhood urinary fluoride levels at ages 6 to 12, although there was some suggestion of
3 an adverse effect. This suggests that the timing of fluoride exposure is an important determinant of
4 fluoride's neurodevelopmental effects, and is consistent with exposures occurring prenatally being more
5 detrimental than those occurring during school-aged years. This is plausible given fluoride's passage
6 through the placental barrier, and the known enhanced vulnerability of the developing brain to
7 neurotoxins during the *in utero* period.

8
9 26. In addition to IQ, we have also found a significant association between prenatal fluoride
10 exposure and some attention deficit hyperactivity disorder (ADHD)-like behaviors on the CRS-R test,
11 including cognitive problems and inattention (Bashash 2018). As with our IQ analyses, the associations
12 were linear, although—as we have found for lead (Huang 2016)—there was some indication in some of
13 the analyses of a ceiling effect at higher doses (i.e., the dose-response curve for cognitive problems and
14 inattention began to flatten above 1 mg/L).

15
16 27. The effect sizes between prenatal fluoride and ADHD behaviors in our cohort were
17 substantial. For those effects which reached statistical significance, increases of 0.5 mg/L in maternal
18 urinary fluoride were associated with 2.4 to 2.8-point higher scores (higher scores reflect indicate poorer
19 performance). Whereas IQ is standardized to a mean of 100, the ADHD behavior scales are standardized
20 to a scale of 50. The effect sizes that we found for prenatal fluoride are similar to what we have found
21 for childhood blood lead levels (Huang 2016).

Figure C: Association Between Maternal Urinary Fluoride & ADHD Behaviors

28. We did not find statistically significant associations between fluoride and ADHD-behaviors on the CPT-II test. Other studies of environmental chemicals have reported similar discrepancies between the two tests, suggesting that they are assessing different constructs. The stronger association that we found between fluoride and ADHD behaviors on the CRS-R scale may be explained by the CRS-R's focus on constructs that rely on attention (e.g., new learning, ability to hold information and complete tasks, organizational skills, etc).

29. The relationship we observed between fluoride and inattention is consistent with some animal research that has reported a relationship between prenatal fluoride exposure and hypoactive behavioral patterns (Mullenix 1995), as well as prior epidemiological research associating fluoride with impaired working memory (Choi 2015). Working memory is linked with the ability to control attention and it is common for youth with ADHD to have weaknesses in working memory (Kasper 2012).

Fluoride's effect on working memory may relate to an effect on the dopamine system, which fluoride has been found to alter in animal studies (Pal & Sarkar 2014). Dopamine is an important modulatory neurotransmitter in planning and initiation of motor responses, activation, switching, reaction to novelty and processing of reward (Fararone 2015).

30. Some have suggested that the “scatter” in the above scatterplots is a basis to doubt the relation between fluoride and the neurodevelopmental outcomes. Such scatter, however, is typical in epidemiological studies of neurotoxicants, as can be seen in the following figure from our study on lead and neurocognitive effects which the EPA relied upon as evidence of low-level lead neurotoxicity when the Agency set the national air standard for lead (Tellez-Rojos 2006, Fig 1, reproduced as Figure D below). We also found similar scatter in our analysis of blood lead and ADHD behaviors, as measured by CRS-R (Huang 2016, Fig. 1, reproduced as Figure E below). The scatter relates to the fact that there are multiple factors that impact on intelligence and behavior; however, unless they are confounders (which we controlled for), they do not preclude the ability to focus on the specific effect of fluoride.

Figure D: Association Between Childhood Blood Lead Levels and Mental Development Index

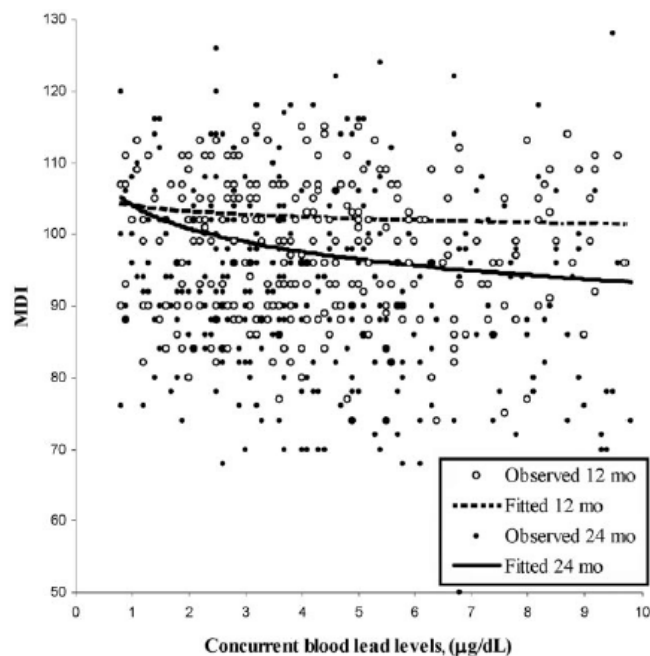
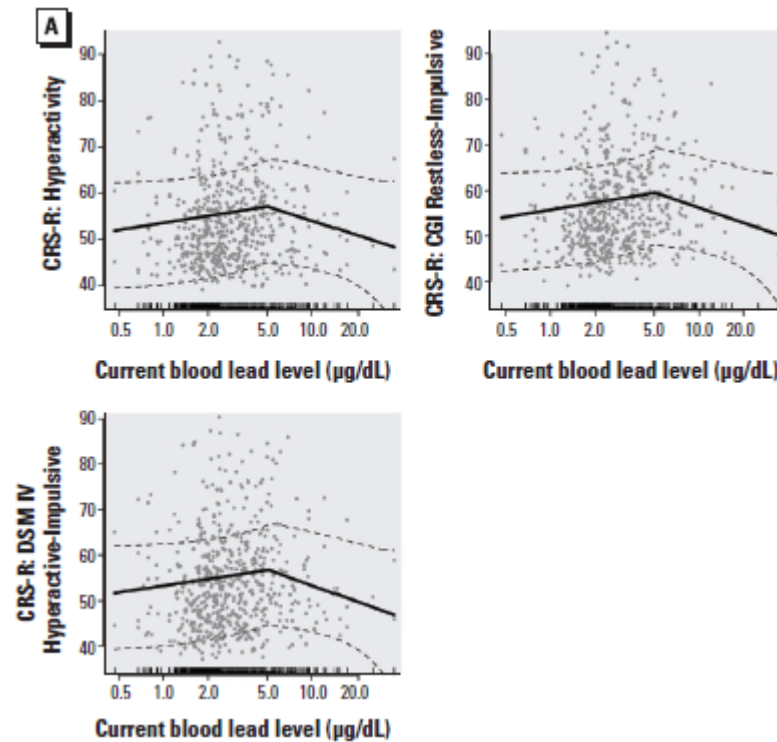


Figure E: Association Between Childhood Blood Lead Levels and ADHD Behaviors



C. The Limitations of Our Studies Do Not Provide Plausible Alternative Explanations for the Results

31. Every epidemiological study, including our studies on fluoride and neurodevelopment, has its limitations. Some of these limitations could theoretically be avoided through the use of human experiments where the toxicant is delivered to the study participants in a controlled and randomized manner. Human experimentation on neurotoxicants, however, is strictly prohibited for obvious ethical reasons. We are thus left with “observational” studies to investigate the impact of environmental toxicants on human health, with prospective cohort studies being the study design best suited for this purpose.

32. As is often the case with epidemiological studies of environmental toxicants, there are limitations in the exposure measurements that we have used in the ELEMENT studies. Our use of spot samples to collect the urine introduces some imprecision into the exposure measurement because urinary

1 fluoride concentrations can fluctuate somewhat throughout the day. This imprecision would have been
2 reduced through the use of 24-hour urine collection samples, and, to a lesser extent, fasting first-morning
3 voids, which are both considered more rigorous measures of fluoride exposure. We compensated for this
4 limitation by using “timed” samples (i.e., second void in the morning) and adjusting for urinary
5 creatinine. Urinary fluoride concentrations fluctuate during the day in large part because fluctuations in
6 an individual’s hydration during the day result in fluctuations in urinary dilution (and therefore, urinary
7 concentrations). Adjusting for urinary creatinine is particularly important because the resulting measure
8 adjusts for urinary dilution. As a result, measures of fluoride in spot urine samples adjusted for
9 creatinine have been found to have excellent agreement with 24-hour samples (Zohouri 2006). Timed
10 spot samples also have an important advantage over 24-hour samples in that they are less imposing on
11 study participants. This is an important consideration when designing cohort studies because the
12 imposition of difficult tasks like collecting 24-hour urines serve to reduce participation, which, in turn,
13 reduces the study’s sample size and statistical power.⁶
14

15 33. Another limitation in our exposure measurements is that, for most of the mothers, we did
16 not have urine samples for every trimester. In our age 4 IQ analysis, 49%, 42%, and 9% of the mother-
17 offspring pairs had urine samples for one, two, and all three trimesters, respectively. In the age 6-12
18 analysis, the respective percentages were 56%, 39%, and 5%; while in the ADHD study, the respective
19 numbers were 57%, 36.4%, and 6.5%. It is common for prospective cohort studies to only have one or
20 two exposure measurements during the prenatal period, but this does not introduce undue imprecision in
21 the exposure estimate, as exposures to a toxicant have limited variation during pregnancy.
22

23 34. Importantly, the imprecision in our exposure measurements does not explain the large
24 and significant associations we observed between maternal urinary fluoride and neurodevelopmental
25

26 ⁶ To put it in simple terms, less people will volunteer to participate in a study if it requires them to
27 collect all of their urine throughout the entire day, including while they are in public spaces, such as
28 their work environment and restaurants, etc.

1 effects. Imprecision in exposure measurements (of the classical or random type, as noted above) is a
2 type of non-differential error that introduces scatter into the analysis which has a generally expected
3 effect of biasing the results towards the null hypothesis. To put it another way, imprecisions in exposure
4 measurements make it *harder*, not easier, to detect an association between an exposure and outcome,
5 much like background noise makes it harder to hear a sound or signal of interest. Imprecision in the
6 exposure measurement is thus anticipated to *obscure* an association, rather than create spurious
7 associations where none otherwise exist. Because of this, improvement in the measurement of a
8 particular exposure tends to reveal and strengthen associations associated with that exposure, not
9 eliminate them.
10

11 35. Another limitation with our studies is, as with most observational studies, we could not
12 rule out the potential for uncontrolled confounding from factors that we did not measure. For example,
13 we did not have data on arsenic which is a neurotoxicant that has been associated with fluoride in certain
14 rural drinking water supplies. While it is always preferable to have more data than less, it is unlikely that
15 arsenic is a meaningful confounder in our cohort. To be a confounder, a covariate must be associated
16 with *both* the outcome *and* exposure. In our cohort, the main source of fluoride is from *salt*, not water.⁷
17 Accordingly, even if arsenic is correlated with fluoride in rural water supplies in Mexico, this
18 association is unlikely to be materially associated with fluoride exposures in our cohort.
19

20 36. Finally, an additional limitation in our studies is that we did not have information on the
21 iodine status of our cohort. Iodine has been theorized to be a potential effect-modifier for fluoride's
22 nervous system effects, i.e., deficiencies of iodine may magnify fluoride's effects, and vice versa (NRC
23 2006). However, failure to control for an effect modifier is unlikely to produce an association between
24 exposure and outcome that does not otherwise exist. Moreover, in Mexico, salt is required by law to be
25

26 ⁷ The water in Mexico City has low levels of fluoride (i.e., 0.16 mg/L) and thus does not present a
27 meaningful exposure in our cohort (Cantoral et al. 2019).

1 iodized. Fluoride levels in our cohort are thus likely correlated with *increased* iodine. To the extent that
2 iodine modifies the effect of fluoride in our population, it is more likely to be in the direction of
3 *reducing* toxicity rather than magnifying it.

4 **D. Implications of Our Findings to the General Population in Water-Fluoridated**
5 **Areas**

6 37. In 2016, we published the largest characterization to date of urinary and plasma fluoride
7 levels throughout pregnancy (Thomas, et al. 2016). At the time we published this study, there had yet to
8 be a population-based study of fluoride exposures among pregnant women in North America, although
9 there were two small-scale studies available from Israel and Poland. The lack of data from North
10 America prevented us, at that time, from comparing the urinary fluoride levels in our cohort with
11 populations from Canada or the United States.

12 38. Urine and plasma fluoride are metrics of the total absorbed dose of fluoride, sometimes
13 referred to as the “internalized” or “bioavailable” dose. These internalized doses do not currently permit
14 one to directly estimate the amount of fluoride that is ingested (i.e., the “external” exposure), nor do they
15 permit the determination of source apportionment of the fluoride exposures. Internalized doses,
16 however, are more relevant than external intake in predicting toxic effects, since they reflect the
17 concentration of toxics that are being delivered to target organs in the body.
18

19 39. Our 2016 study presented the urinary and plasma fluoride levels from 825 and 330
20 pregnant women from our cohort, respectively. The urine samples were collected and measured using
21 the procedures discussed above for our neurodevelopmental papers (i.e., early morning 2nd voids that
22 were adjusted for creatinine), and both the urine and plasma samples were tested under the direction of
23 Dr. Angeles Martinez-Mier from Indiana University, a world leader in the measurement of fluoride in
24 biological samples.
25

26 40. The average creatinine-adjusted urinary fluoride level across all three trimesters in the
27

1 ELEMENT cohort was 0.91 mg/L, with a standard deviation of 0.4 mg/L.⁸ The average plasma fluoride
2 level across all three trimesters was 0.0221 mg/L, with a standard deviation of 0.0164 mg/L.⁹

3 41. By the time we published our 2018 study on ADHD behaviors, general population data
4 had become available on maternal urinary fluoride levels in pregnancy (Till 2018). As we noted in our
5 2018 study, the maternal fluoride levels in the Canadian study are similar to the levels in our cohort
6 (Bashash 2018). The mean (creatinine-adjusted) maternal urinary fluoride level among pregnant women
7 living in the water-fluoridated areas of Canada was 0.87 mg/L, with a standard deviation of 0.50 mg/L,
8 which is clearly in the same range as our cohort (i.e., mean = 0.91 mg/L, SD = 0.4 mg/L). The urine
9 samples in the Canadian study were tested by Dr. Martinez-Mier using the same creatinine-adjustment
10 method, which increases the comparability of the data.
11

12 42. The similarity in maternal urinary fluoride levels between pregnant women in the
13 ELEMENT cohort and water-fluoridated areas of the Canadian cohort is consistent with the fact that
14 both populations are receiving so-called “optimal” levels of fluoride through fluoridation programs (i.e.,
15 salt fluoridation in Mexico, and water fluoridation in Canada). Since salt fluoridation programs are
16 designed to replicate the doses provided by fluoridated water, it is a reasonable, first-order expectation
17 that populations living in salt-fluoridated and water-fluoridated areas will receive similar doses of
18 fluoride.
19

20 43. The maternal urinary fluoride data from the ELEMENT cohort and water-fluoridated
21 areas of Canada support the conclusions that the two populations have essentially the same *internalized*
22 doses of fluoride. The internalized doses in water-fluoridated areas are thus in the range that we have
23

24 ⁸ The 75th and 90th percentile values were 1.09 mg/L and 1.37 mg/L, respectively.

25 ⁹ We tested for and found no correlation between creatinine-adjusted urinary fluoride and
26 sociodemographic variables, including maternal age, maternal education, child sex, smoking status, birth
27 order, and cohort. Although we found a trend towards increasing urinary fluoride levels through the first
28 22-23 weeks of pregnancy, and a reduction thereafter, these trends were not statistically significant
(Thomas 2016).

1 found to be associated with substantial and significant neurodevelopmental harms in the ELEMENT
2 cohort.

3 44. Although direct comparisons of *external* fluoride intake cannot yet be made, such
4 information is not necessary to generalize the neurodevelopmental results from the ELEMENT cohort to
5 water-fluoridated areas.

6 45. There is no identified reason to believe that the neurodevelopmental effects of fluoride
7 will differ by the source of exposure, be it fluoridated salt or fluoridated water; once inside the body the
8 source of fluoride is immaterial.

9 46. For the reasons stated, it is my opinion to a reasonable degree of scientific certainty that
10 the results of the ELEMENT studies support the conclusion that fluoride is a developmental
11 neurotoxicant at levels of internalized exposure seen in water-fluoridated communities.
12

13
14 I declare under penalty of perjury, under the laws of the United States, that the foregoing
15 is true and correct to the best of my knowledge and belief.
16

17 Executed on May 20, 2020, in Seattle Washington.

18
19 

20 HOWARD HU, MD, MPH, ScD
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- NRC. 2006. Fluoride in Drinking Water: A Scientific Review of EPA's standards. National Academies Press, Washington, D.C.

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2 acid metabolism, DNA damage and biogenic amines in rat brain. *Environ. Toxicol. Pharmacol.* 2014,
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5 Arrieta L, Wright RO, Hernández-Avila M, Hu H. Longitudinal associations between blood lead
6 concentrations lower than 10 microg/dL and neurobehavioral development in environmentally exposed
7 children in Mexico City. *Pediatrics* 2006;118(2):e323-e330.
- 8 Thomas DB, Basu N, Martinez-Mier EA, Sanchez BN, Zhang Z, Liu Y, Parajuli RP, Peterson K,
9 Mercado-Garcia A, Bashash M et al: Urinary and plasma fluoride levels in pregnant women from
10 Mexico City. *Environ Res* 2016, 150:489-495.
- 11 Thomas D, Sanchez B, Peterson K, Basu N, Martinez-Mier EA, Mercado-Garcia A, Hernandez-Avia M,
12 Till C, Bashash M, Hu H, Tellez-Rojo M. Prenatal fluoride exposure and neurobehavior among children
13 1-3 years of age in Mexico. *British Medical Journal* 2018; 75(Suppl 1):A10.
- 14 Till C, Green R, Grundy JG, Hornung R, Neufeld R, Martinez-Mier EA, Ayotte P, Muckle G, Lanphear
15 B: Community Water Fluoridation and Urinary Fluoride Concentrations in a National Sample of
16 Pregnant Women in Canada. *Environ Health Perspect* 2018, 126(10):107001.
- 17 Wechsler, D. (1991). Wechsler intelligence scale for children, 3rd ed. (WISC-III). San Antonio, TX:
18 Psychological Corporation.
- 19 Wechsler, D. (1999). Wechsler abbreviated scale of intelligence (WASI) manual. San Antonio, TX:
20 Psychological Corporation.
- 21 Zohouri F, Swinbank C, Maguire A, Moynihan P. 2006. Is the fluoride/creatinine ratio of a spot urine
22 sample indicative of 24-h urinary fluoride? *Community Dent Oral Epidemiol* 34(2):130–138,
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**CURRICULUM VITAE OF
HOWARD HU, MD, MPH, ScD**

CURRICULUM VITAE

Date Prepared: May, 2019

NAME: Howard Hu

PRIMARY AFFILIATION: School of Public Health, University of Washington

SECONDARY AFFILIATION: School of Public Health, University of Michigan

CONTACT: Howard Hu, M.D., M.P.H., Sc.D.

Email: hhu5@uw.eduLINKS: https://deohs.washington.edu/faculty/hu_howard<https://www.linkedin.com/in/howard-hu-059703a/?trk=public-profile-join-page>

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EDUCATION:

9/1973-6/1976	Biology	B.Sc.	Brown University
9/1977-6/1982	Medicine	M.D.	Albert Einstein College of Medicine
9/1979-6/1980 (degree in 6/1982*)		M.P.H. (Occ Hlth)	Harvard School of Public Health
9/1985-6/1986	Epidemiology	M.S.	Harvard School of Public Health
7/1986-6/1990	Epidemiology	Sc.D.	Harvard School of Public Health

* Awarding of the Harvard M.P.H. to medical students is delayed until the M.D. degree is conferred

POSTDOCTORAL TRAINING:

Research Fellowships

7/1987-6/1988 Occupational Health Research Fellow, Dept. of Environmental Health
Harvard School of Public Health

Internship and Residencies

7/1982-6/1983	Intern in Medicine	Boston City Hospital
7/1983-6/1984	Junior Assistant Resident, Internal Medicine	Boston City Hospital
7/1984-6/1985	Senior Assistant Resident, Internal Medicine	Boston City Hospital
7/1985-6/1987	Resident, Occupational Medicine	Harvard School of Public Health

CERTIFICATION AND LICENSURE:

1984	Massachusetts Medical License Registration
1985	American Board of Internal Medicine, Diplomate
1987	American Board of Preventive Medicine, Diplomate (Occupational Medicine)
2006	Michigan Medical License Registration
2013	College of Physicians & Surgeons of Ontario
2018	Washington State Medical License Registration

ACADEMIC APPOINTMENTS:

9/1988-6/1992	Instructor in Medicine Department of Medicine, Harvard Medical School
9/1988-6/2006	Associate Physician (Clinical and Research), Channing Laboratory, Department of Medicine, Brigham & Women's Hospital
9/1990-6/1994	Assistant Professor of Occupational Medicine Department of Environmental Health, Harvard School of Public Health

CV: Howard Hu, M.D., M.P.H., Sc.D.

7/1992-6/1997 Assistant Professor of Medicine
Department of Medicine, Harvard Medical School

7/1994-6/2002 Associate Professor of Occupational Medicine
Department of Environmental Health, Harvard School of Public Health

7/1997-8/2006 Associate Professor of Medicine
Department of Medicine, Harvard Medical School

7/2002-8/2006 Professor of Occupational and Environmental Medicine (tenured)
Department of Environmental Health, Harvard School of Public Health

9/2006-6/2012 Chair and Professor of Environmental Health Sciences (tenured), Department of
Environmental Health Sciences, University of Michigan School of Public Health

9/2006-8/2009 Adjunct Professor of Occupational and Environmental Medicine
Department of Environmental Health, Harvard School of Public Health

9/2006-6/2012 Research Associate Physician, Channing Laboratory, Department of
Medicine, Brigham & Women's Hospital

5/2007-2012 Professor of Epidemiology, University of Michigan School of Public Health

5/2007-2012 Professor of Internal Medicine, University of Michigan Medical School

1/2009-2012 NSF International Endowed Department Chair, University of Michigan School of
Public Health, Department of Environmental Health Sciences

7/2012-2018 Professor of Environmental Health, Epidemiology and Global Health (tenured)
Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario,
Canada (on sabbatical/administrative leave, 2017-2018)

7/2012-2018 Professor, School of Medicine, University of Toronto, Toronto, Ontario, Canada

7/2012- Adjunct Professor, Department of Environmental Health Sciences, University of
Michigan School of Public Health

7/2012-2013 Director, Dalla Lana School of Public Health, University of Toronto, Toronto,
Ontario, Canada

7/2013-6/2017 Founding Dean, Dalla Lana School of Public Health, a Faculty of the University
of Toronto, Toronto, Ontario, Canada

7/2017- Affiliate Professor (started as Visiting Scholar until December, 2017),
Department of Occupational and Environmental Health Sciences, University of
Washington School of Public Health, Seattle, WA

ADMINISTRATIVE APPOINTMENTS:

7/1991-6/2006 (Founding) Director, Metals Epidemiology Research Group, Channing Laboratory,
Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, and
Department of Environmental Health, Harvard School of Public Health

7/1992-6/1995 Director, Commission to Investigate the Health and Environmental Effects of Nuclear
Weapons Production, International Physicians for the Prevention of Nuclear War

7/1996-6/2006 Director, Residency Program in Occupational and Environmental Medicine, Harvard
School of Public Health

7/1996-8/2006 Director, Occupational and Environmental Medicine Core, National Institute for
Occupational Safety and Health Educational Resource Center at the Harvard School of

CV: Howard Hu, M.D., M.P.H., Sc.D.

Public Health

- 7/1998-6/2004 (Founding) Medical Editor, Environmental Health Perspectives (official journal of NIEHS)
- 7/2000-8/2006 Associate Director, the Harvard NIEHS Environmental Sciences Center, Harvard School of Public Health
- 7/2004-6/2009 (Founding) Principal Investigator and Director, Harvard Center for Children's Environmental Health and Disease Prevention Research (co-PI and co-Director after 9/1/08)
- 9/2006-6/2012 Chair, Department of Environmental Health Sciences, University of Michigan School of Public Health
- 9/2006-2012 Director, Occupational Epidemiology Core, NIOSH Education and Research Center, University of Michigan
- 9/2006-2012 Co-Director, Michigan-Harvard/Harvard-Michigan Metals Epidemiology Research Group
- 7/2009-2011 Director, NIA T32 Training Grant in Aging and Public Health, University of Michigan School of Public Health
- 1/2010-2012 Chair, Faculty Steering Committee on Global Health, University of Michigan School of Public Health
- 4/2011-2012 (Founding PI) and Director, University of Michigan NIEHS P30 Core Center.
- 7/2012-2013 Director, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
- 7/2013-6/2017 Founding Dean, Dalla Lana School of Public Health, a Faculty of the University of Toronto, Toronto, Ontario, Canada

CLINICAL APPOINTMENTS:

- 7/1985-6/1987 Attending Physician, Emergency Department, Whidden Memorial Hospital
- 7/1985-6/1988 Assistant Visiting Physician, Department of Medicine, Boston City Hospital
- 1/1985-6/2006 Consultant in Occupational and Environmental Medicine, Center for Occupational and Environmental Medicine, Northeast Specialty Hospital (formerly known as the Olympus Specialty Hospital, the Massachusetts Respiratory Hospital, and Norfolk County Hospital).
- 3/1987-9/1987 Attending Physician, Occupational Health Program, University Hospital/Boston University Medical Center
- 7/1988-9/2006 Associate Physician, Brigham and Women's Hospital
- 7/1990-6/1995 Occupational/Environmental Medicine Consultant, Brigham and Women's Hospital Employee Health Services
- 7/2007-2012 Associate Physician, Division of General Medicine, Department of Medicine, University of Michigan Health System
- 1/2019-present Staff Physician, RotaClinic-Lake City, Seattle, WA

OTHER ACADEMIC POSITIONS and MAJOR VISITING APPOINTMENTS:

CV: Howard Hu, M.D., M.P.H., Sc.D.

7/1987-6/1990 Visiting Physician, South Cove Health Center, Boston (Chinatown)
 7/1996-8/2006 Associate, Center for Health and the Global Environment, Harvard Medical School
 2/1997 Alice Hamilton Visiting Professor, Division of Occupational and Environmental
 Medicine, Department of Medicine, University of California at San Francisco
 11/2000- Visiting Scientist, Sri Ramachandra Medical College and Research Institute
 7/2010- Senior Consultant, Tianjin Centers for Disease Control and Prevention, Tianjin,
 China
 10/2012- Visiting Professor, Shanghai Key Laboratory of Children's Environmental Health,
 Xinhua Hospital, Shanghai Jiao-Tung University, China
 7/2013-6/2016 Visiting Professor, Shanghai Jiao Tong School of Medicine, China
 5/2015- Affiliate Scientist to the Li Ka Shing Knowledge Institute, St. Michael's Hospital,
 Toronto, Canada

MAJOR RESEARCH INTERESTS:

1. Environmental and molecular epidemiologic research related to heavy metals, potential endocrine disruptors, other neurotoxicants, carcinogens, etc.
2. Gene-environment interactions; epigenetic dysregulation
3. Fetal/early life exposures and long-term effects
4. Aging-environment interactions
5. Environmental health, health inequities and health disparities, human rights
6. Health and the global environment
7. "Big Data" for population health
8. Environmental sensitivities/Multiple chemical sensitivities

GRANTS (as PI, Co-PI, or primary mentor only):

Past Funding:

1980 (summer) Montefiore Hospital, Bronx NY, PI; \$2,000 (approx)
 A study of rural and occupational health in Tulua, Colombia, South America
 1982 (summer) Albert Einstein College of Medicine, PI; \$3,000 (approx)
 A study of occupational/environmental health in Shanghai, China
 7/1987-6/1989 NIEHS Center Grant ES00002 Pilot Project, PI; \$12,000
 The Long-term Renal and Neurologic Effects of Childhood Plumbism
 7/1989-6/1990 NIEHS subcontract 7083-1, PI; \$50,000 (approx)
 The Use of X-Ray Fluorescence to Measure Lead Burden and Childhood Lead
 Exposure
 7/1990-6/1992 Agency for Toxic Substances and Disease Registry, PI; \$150,000 (approx)
 "Clinical Environmental/ Occupational Medicine Research Fellowship Award",
 7/1990-6/1991 NIEHS Center Grant ES00002 Pilot Project, PI; \$12,000
 The Metabolic Effects of Pregnancy and Lactation on Lead Burden

CV: Howard Hu, M.D., M.P.H., Sc.D.

7/1990-6/1991 Harvard School of Public Health Basic, PI
Research Support Grant; \$10,000
K-X-Ray Fluorescence Measured Lead Burden

10/1991-11/1991 NIOSH Special Grants, PI; \$50,000 (approx)
The Carpenters Lead Project

4/1991-3/1996 NIEHS/R01, PI; \$2,200,000 (approx)
The Epidemiology of Lead, Diet and Blood Pressure

7/1991-6/1996 NIEHS/R01 supplement, PI; \$240,000 (approx)
The Epidemiology of Lead, Diet and Blood
Pressure--Research Supplement for Minority Investigator

7/1992-6/1995 NIEHS/R01 (Office of Research on Women), PI; \$200,000 (approx)
Lead and Hypertension in Women

7/1993-6/1996 NIEHS/subcontract, PI; \$150,000 (approx)
Exposure to Neurotoxins as Risk Factors for Amyotrophic Lateral Sclerosis

7/1995-6/1998 State of Washington, Department of Labor, PI; \$350,000 (approx)
SPECT Imaging of the Brain in Patients with Multiple Chemical Sensitivity
Syndrome and Controls

7/1996-6/1997 NIEHS Center Grant ES00002 Pilot Project, PI; \$15,000
Electrocardiographic abnormalities in association with low-level lead exposure
among middle-aged to elderly men: the Normative Aging Study

4/1995-3/2000 NIEHS Project PI (Program Project PI: Richard Monson); \$1,800,000 (approx)
Lead Exposure, Accumulation in Bone, and Reproductive Toxicity Among Men and
Women In Mexico

4/1995-3/2000 NIEHS Project PI (Program Project PI: Richard Monson); \$1,900,000 (approx)
Lead Exposure, Accumulation in Bone, and Cognitive Toxicity Among Elderly Men
and Women

6/1997-5/2002 NIEHS/R01 ES05257 PI; \$2,312,274
Lead Biomarkers, Aging, and Chronic Disease

7/1997-6/1999 NIEHS Center Grant ES00002 Pilot Project, PI; \$10,000
The effect of genetic polymorphisms of metallothionein-IIA on mRNA levels in
middle-aged to elderly men: the Normative Aging Study

7/1998-6/2003 NIEHS/R01 PI (with no-cost extension; 5R01ES007821); \$2,291,833
Lead Dose Biomarkers, Reproduction, and Infant Outcomes

7/1999-6/2000 NIEHS Center Grant ES00002 Pilot Project, co-PI; \$14,000
Magnetic Resonance Spectroscopy in the Evaluation of Lead Neurotoxicity: the
Normative Aging Study

7/2000-6/2001 MAVERIC (Massachusetts Area Veterans Epidemiology Resource and Institute
Center) Pilot Project PI (with Dr. Robert Wright, co-PI); \$10,000
The Use of Magnetic Resonance Spectroscopy in Lead Poisoning

7/2000-6/2001 NIOSH Center Grant Pilot Project, PI (with Dr. Robert Wright, co-PI); \$12,000
Interaction between ApoE Genotype and Lead Exposure in the Development of
Cognitive Impairment

7/2002-6/2004 The Rasmussen Foundation/Health Care Without Harm; \$50,000

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- Medical Use of Phthalate Containing Products in the Neonatal Intensive Care Unit and Biomarkers of Neonatal Phthalate Metabolites
- 7/2002-6/2003 NIEHS Center Grant Pilot Project, PI; \$8,000
Vitamin D Receptor Gene and Bone Lead in Reproduction
- 3/2004-2/2005 The Critelli Family Foundation; \$10,000
Review of Environmental Cadmium Exposure and Toxicity
- 4/2000-3/2007 NIEHS Project Leader (Program Project PI: Richard Monson; 5P01ES05947); \$2,472,677; Controlled Trial in Pregnancy of Dietary Supplements for the Suppression of Bone Resorption and Mobilization of Lead into Plasma (no cost extension)
- 4/2000-3/2007 NIEHS Project co-Leader (Program Project PI: Richard Monson; 5P01ES05947); \$1,210,000 (approx); A Community-Based Study of Lead Exposure Pathways, Biomarkers of Dose, Health Effects, and Phytoremediation Strategies at the Tar Creek Superfund Site (no cost extension)
- 4/2002-9/2007 NIEHS/R01 PI (5R01ES010798); \$3,011,295
Gene-Metal Interactions and Parkinson's Disease
- 10/2003-9/2007 NCMHI/P20 Project Leader (MD000501-01; Hughes Harris, PI); \$828,781 (Project)
"FAMU and Harvard Center for Health and Health Care Disparities"
- 8/2003-7/2008 NIEHS/R01 PI (2R01ES05257-11A2); \$3,357,424 (became co-PI in 2007 after move to University of Michigan)
Lead-Gene Interactions and Cognition
- 6/2004-3/2009 NIEHS/P01 PI (5 P01ES012874-01); \$6,662,670 (became co-PI in 2006 after move to University of Michigan)
Metals Mixtures and Children's Health (Center for Children's Environmental Health and Disease Prevention Research)
- 7/2002-12/2009 NIH/R03 PI (1R03TW005914; no cost ext through 2008); \$192,000 (approx)
Lead, Genes, and Cognition in Children in Chennai, India
- 9/2006-7/2011 NIEHS/R01 PI (R01ES0007821); \$3,116,831
Fetal Origins of Neurobehavior: Lead and Cholesterol Metabolism Interactions
- 7/2006-6/2011 NIEHS/R01 co-PI (R01ES013744; PI Wright), \$3,200,000
Stress, Lead, Iron Deficiency and Neurodevelopment
- 7/2006-6/2011 NIEHS/R01 co-PI (R01ES014930; PI Wright), \$2,800,000
Metal Mixtures and Neurodevelopment
- 2/2008-2/2010 Michigan Institute for Clinical and Health Research (MICHHR; home of the UM CTSA; UL1RR024986) Pilot Project PI; \$26,000 (no cost extension)
Epigenetics of Early Life Events and Environmental Toxicants
- 4/2009-4/2010 Michigan Alzheimer's Disease Research Center Pilot Project PI, \$25,000
Environment, Epigenetics and Alzheimer's Disease (no cost extension)
- 12/2009-12/2010 University of Michigan Center for Global Health Pilot Project PI, \$25,000
Climate Variability and Impacts on Mortality and Morbidity in Chennai, India: A Pilot Project Stemming from the 2009 U.S.-India Workshop on Climate Change and Public Health, Goa India (no cost extension)

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- 9/2009-9/2010 Michigan Institute for Clinical and Health Research (MICHHR; home of the UM CTSA; UL1RR024986) Pilot Project PI; \$26,000 (no cost extension)
Epigenetics and Epigenomics in the Etiology of Alzheimer Disease
- 7/2008-6/2011 NIA/T32 PI (T32AG027708); \$450,000
Interdisciplinary Training Program in Aging and Public Health
- 4/2010-3/2015 NIEHS P42 Superfund Co-Inv, Project 2, Co-investigator (P42ES017198; PI: Alshawabkeh, Project 2 Leader: Meeker) Puerto Rico Testsite For Exploring Contaminant Threats, \$12,000,000
- 4/1/2011-6/2015 NIEHS Core Environmental Health Sciences Center, Founding PI and Director (until 2012; now consultant; P30 ES017885), \$ 4,620,100;
“Lifestage Exposures and Adult Disease”
- 4/2010-3/2014 NIEHS/EPA P20 Co-PI and Clin Health Specialist (P20 ES018171; PI Peterson) Formative Children’s Environmental Health and Disease Prevention Center, \$1,959,960; “Perinatal Exposures, Epigenetics, Child Obesity & Sexual Maturation”
- 7/1/2013-6/30/2014 CIHR, Canadian Institute for Health Services and Policy Research; Planning Grants-Priority Announcement:Partnerships for Health System Improvement; PI, \$24,992
“The Surviving Opioid Overdose with Naloxone (SOON) Project and Roundtable”
- 07/1/11-06/30/16 NIEHS K01 ES019909 (co-mentor; PI: Somers)
“Immune dysfunction associated with early life heavy metal exposure”
- 4/1/12-3/30/17 NIEHS R01ES013744 (consultant; PI: Wright; Mt Sinai School of Medicine)
“Stress-Lead Interactions and Child Development”
- 7/1/2012-7/1/2017 European Commission (EC), Funded under FP7-Health, Project 304925, co-Investigator; PI, epidemiologic studies, \$6,000,000 E
“A novel micronutrient-based strategy to prevent hearing impairments: test and road to market for age-related hearing loss and preservation of residual hearing”

Current Funding

- 6/1/2012-7/1/2019 1R01ES021446-01, PI, \$4,140,000 (parent + supplement awards);
“Prenatal and Childhood Exposure to Fluoride and Neurodevelopment”
- 5/15/2015-5/15/2019 Health Canada; PI, \$200,000 (Phase 1); \$1,400,000 (proposed Phase 2)
“A Community-based First Nation Study of Cancer and the Environment in Northern Ontario”
- 4/1/13-3/31/23NIEHS/EPA P01ES022844 (co-inv; PI: Peterson at the University of Michigan)
“Lifecourse Exposures & Diet: Epigenetics, Maturation & Metabolic Syndrome.”
- 7/1/16-6/30/21 CIHR (co-PI; Director; PI: Jeffrey Brook at the Dalla Lana School of Public Health) \$4,700,000 CDN
“CANadian Urban Environmental (CANUE) Health Research Consortium”
- 9/1/16-8/31/21 NIH 5R01ES026033-02, (consultant; PI: Arora at Mt. Sinai School of Medicine) \$648,000 “Novel Biomarker to Identify Critical Windows of Susceptibility to Metal Mixture”

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Applications Under Review

Wellcome Trust, co-investigator (PI: P Landrigan)

“Quantifying the Cognitive and Economic Benefits of Reducing Air Pollution to Achieve Climate Change Mitigation”

Competitive Renewal Application In Progress

R01ES021446-01, PI, \$4,140,000

A Prospective Study of Early Life Exposure to Fluoride, Thyroid Function, and Neurobehavioral Outcomes

Amended Application In Progress

R01ES007821-11, PI, \$4,800,000;

Early Life Toxicants and Cardiovascular Outcomes” (priority score 27 by CASE Study section; 25th percentile)New Application in Progress

Wellcome Trust, xxx, multiple-PI

Addressing Two Critical Gaps in Understanding the Impacts of Lead Exposure on the Global Burden of Disease: (a) Impacts on Cardiovascular Disease; (b) Exposures and Sources in Low and Middle-Income Countries

HONORS AND AWARDS:

1978-1982 National Health Service Corps Scholarship

1985-1988 National Research Service Award

1990-1992 Agency for Toxic Substances and Disease Registry Clinical Environmental Medicine Award

1994 Will Solimene Award of Excellence, American Medical Writers Association, for: Chivian E, McCally M, Hu H, Haines H, eds. *Critical Condition: Human Health and the Environment*. Cambridge: The MIT Press, 1993.

1997 Alice Hamilton Lecturer, University of California at San Francisco

1998 First Prize for Best Infant Nutrition Research, Instituto Danone, Mexico (for González-Cossío T, Peterson KE, Sanín L, Fishbein SE, Palazuelos E, Aro A, Hernández-Avila M, Hu H. “Decrease in birth weight in relation to maternal bone lead burden.” Published in *Pediatrics*)

1999 National Institute for Environmental Health Sciences “Progress and Achievement of the

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CV: Howard Hu

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- Year Award", 1998-1999
- 1999 True Memorial Lecturer, Maine Medical Center, Portland ME.
- 2000-2001 Faculty Sabbatical Award, Harvard School of Public Health
- 2000-2001 Senior Fulbright Scholar in India
- 2001 Hoopes Prize, Faculty Mentorship (for Senior Thesis of Charles Lin, "More than Black and White: Lead Poisoning as an Environmental Justice Issue in Boston")
- 2003 Best Paper in Preventive Medicine by a Medical Student (for Senior Thesis of Vanitha Janakiraman; Janakiraman V, Hu H, Mercado-Garcia A, Hernandez-Avila M. A randomized crossover trial of nocturnal calcium supplements to suppress bone resorption during pregnancy. *Am J Prev Med* 2003;24:260-4.). American College of Preventive Medicine, Ulrich and Ruth Frank Foundation for International Health.
- 2004 Das Travel Grant Award, The South Asia Initiative, Harvard University (for Travel in India)
- 2005 Adolph G. Kammer Merit in Authorship Award, the American College of Occupational and Environmental Medicine (for Rhodes D, Spiro A, Aro A, Hu H "Relationship of Bone and Blood Lead Levels to Psychiatric Symptoms: The Normative Aging Study", Published in the *Journal of Occupational and Environmental Medicine*)
- 2006 Teacher of the Year Award, Occupational/Environmental Medicine Residents, Harvard School of Public Health
- 2006 Harriett Hardy Award, the New England College of Occupational and Environmental Medicine
- 2009 Linus Pauling Award for Lifetime Achievements, American College for the Advancement of Medicine
- 2011 Award for Excellence, American Public Health Association
- 2015 John R. Goldsmith Award for Outstanding Contributions to Environmental Epidemiology, International Society for Environmental Epidemiology
- 2016 Election to Fellowship, Canadian Academy of Health Sciences

MEMBERSHIPS IN PROFESSIONAL SOCIETIES

Memberships

- 1981- American Public Health Association (APHA)
- 1982-2006 Massachusetts Coalition for Occupational Safety and Health
- 1983-1989 American College of Physicians
- 1985- Physicians for Social Responsibility
- 1987- Physicians for Human Rights
- 1990- International Society for Environmental Epidemiology (ISEE)
- 1990-2000 American Association for the Advancement of Science
- 1990-2006 Association of Occupational and Environmental Clinics (AOEC)
- 1991- International Physicians for the Prevention of Nuclear War (IPPNW)

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1994-1996 Society for Occupational and Environmental Health (SOEH)
2000-2012 American College of Occupational and Environmental Medicine (ACOEM)
2009-2012 Society of Toxicology
2012- Canadian Public Health Association (CPHA)

Committee Assignments

1981-1982 Program Committee, Occupational Safety and Health Section, APHA
1987-1988 Program Committee, Asian-American Caucus, APHA
1992-1998 Membership Committee, ISEE
1995-1998 Quality Assurance Committee, AOEC
1997-1998 Program Committee, 1998 Superfund Basic Research Program, Annual National Meeting
2001-2006 Program Committee, New England College of Occupational and Environmental Medicine
Annual Meetings

EDITORIAL POSITIONS AND BOARDS:

1977-1982 Einstein Community Health Newsletter
1988-1992 Bookreview Co-Editor, Section on Occupational Safety and Health, Am Public Health
Assoc.
1993- Journal of Health and Human Rights
1998- Environmental Health Perspectives (Founding Medical Editor, 1998-2004; Associated
Editor, 2004-)
2004- American Journal of Industrial Medicine
2007-2009 Faculty of 1000 Medicine
2017- Current Environmental Health Reports
2017- Faculty of 1000 Medicine

PEER REVIEW SERVICE

American Journal of Epidemiology
American Journal of Industrial Medicine
Archives of Environmental and Occupational Health
Biomed Central
Circulation
Environmental Health
Environmental Health Perspectives
Environment International
Environmental Research
Epidemiology

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Indian Journal of Medical Research
 Journal of Health and Human Rights
 Journal of the American Medical Association
 Kidney International
 Lancet
 New England Journal of Medicine
 Pediatrics
 PLOS One
 Science of the Total Environment

TEACHING:

1. LOCAL CONTRIBUTIONS (at the Harvard School of Public Health, 1985-2006)

1985-	“Toxicology of the Kidney and Urinary Tract” Guest Lecturer for TOX204a,b
1988-	“Occupational Health” Guest Lecturer for EH201a,b
1989-1992	“Lead Toxicology” Guest Lecturer for TOX204a,b
1990-	<u>Grand Rounds in Occupational/Environmental Medicine</u> Director
1990-2000	<u>Introduction to Occupational and Environmental Medicine (EH232c,d)</u> Course director, lecturer
1990-	“The Epidemiology of Lead Exposure, Dose, and Toxicity” Guest Lecturer for EPE215c,d and EPE215t
1990-	“Solvent toxicity” Fundamentals of Industrial Hygiene, Continuing Education Department
1992	"Current Research on Lead", Metals Epidemiology Research Group Seminar Presenter
1992	"Lead Poisoning Without a Known Source in a Hyperthyroid Patient" Case discussant, Grand Rounds in Occupational and Environmental Medicine
1992-	“Biological Markers of Lead Dose” Guest Lecturer, EHE280c,d
1994-	“Screening for Lead Toxicity” Guest lecturer, EPI227d
1994-	“Lead Exposure and Biological Monitoring” Guest Lecturer, ID263b
1994-	“Case Study: Lead” Guest Lecturer and Case Discussant, EH202d
1996-	<u>Introduction to Environmental Health (EH201b)</u>

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- 1997- Course director and lecturer
Human Health and Global Environment Change (EH278a,b)
 Course Co-developer, Co-director, and lecturer

Hospital courses and Invited Teaching Presentations (Harvard-affiliated Hospitals)

- 1990 Guest Lecturer on Occupational Medicine
 Residency Program, Department of Medicine, Brigham and Women's Hospital
- 1994 Speaker, Grand Rounds; "Is Lead a Ticking Time Bomb?"
 Department of Obstetrics and Gynecology, Brigham and Women's Hospital
- 1994 Speaker, Grand Rounds; "Is Lead a Ticking Time Bomb?"
 Department of Medicine, Brockton V.A. Hospital
- 1994 Speaker, Symposium on Preventive Medicine and Clinical Epidemiology,; "Is Lead a Ticking Time Bomb"; Brigham and Women's Hospital
- 1995 Discussant, "Multiple Chemical Sensitivity", Occupational/Environmental Medicine
 Grand Rounds, Occupational Health Program, Harvard School of Public Health
- 1996 Guest lecturer, "Lead Toxicity as a Paradigm for a Regional and Global Health Hazard", Environmental Health Student Group, Holmes Society, Harvard Medical School
- 1997 Speaker, "Mobilization of maternal bone lead as a hazard to the fetus", Grand Rounds, Dept. of Neonatology, Beth Israel Hospital, Boston, MA
- 2000 Guest lecturer, "Update on Lead Toxicity Research", Program in Pediatric Toxicology, Children's Hospital
- 2000 Discussant, "Adult Lead Toxicity", Weekly Case Round, Department of Medicine, Brigham and Women's Hospital, Boston.
- 2000 Lecturer, "Update on Lead Toxicity, Hypertension, and Chronic Renal Failure", Renal Rounds, Division of Nephrology, Department of Medicine, Brigham and Women's Hospital, Boston.
- 2002 Lecturer, "Maternal Bone Lead as a Threat to Fetal Development", Program in Neonatology, Beth Israel-Deaconess Hospital, Boston, MA

Doctoral student committees

Chair and member:

- | | |
|-----------------------|---|
| Dr. Rokho Kim | Dr.P.H. Occupational Health and Epidemiology, '96 |
| Dr. Yawen Cheng | Sc.D. Epidemiology, '98 |
| Dr. Sharon Tsaih | Sc.D. Epidemiology, '99 |
| Dr. Hung Yi Chuang | Sc.D. Occupational Health, '99 |
| Dr. Adrienne Ettinger | Sc.D. Environmental Health, '03 |
| Dr. Florence Wang | Sc.D. Environmental Health, '05 |
| Dr. Sung K. Park | Sc.D. Environmental Health, '05 |
| Dr. Pradeep Rajan, | Sc.D. Occupational Health, '06 |

Member/Advisor:

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Dr. How Ran Guo	Sc.D. Occupational Health, '94
Dr. Joshua Cohen	Sc.D. Health Policy and Management, '94
Dr. Jane Hoppin	Sc.D. Environmental Health, '95
Dr. Salma Elreedy	Sc.D. Environmental Health, '97
Dr. Mary Jean Brown	Sc.D. Maternal and Child Health, '00
Dr. Brisa Sanchez	Sc.D. Biostatistics, '06
Dr. Ami Zota	Sc.D. Environmental Health, '07
Dr. Ananya Roy	Sc.D. Environmental Health, '08
Dr. Elissa Wilker	Sc.D. Environmental Health, '09

Post-doctoral fellow mentor:

Dr. Marinelle Payton (Channing Lab), Dr. Susan Korrick (Channing Lab), Dr. Rokho Kim (Channing Lab), Dr. Viji Potula (HSPH Research Fellow), Dr. Barbara Nowak (Visiting Scientist from Silesian University School of Medicine, Poland), Dr. Robert Wright (Channing Lab), Dr. Ming Tsuang Wu (HSPH Research Fellow), Dr. Yawen Cheng (Channing Lab), Dr. Geeta Mathur (neonatology fellow at the Brigham and Women's Hospital), Dr. Sri Hari Bojja (HSPH Research Fellow), Dr. Hae-Kwan Cheong (Visiting Scientist from Dongguk University School of Medicine, S. Korea), Dr. Sahar Elmarsafawy (HSPH Research Fellow), Dr. Jing Lu (Visiting Scientist from the Chinese Academy of Preventive Medicine), Dr. Dieter Affeln (Occ/Env Med Fellow), Dr. Ahmed Gomaa (Occ/Env Med Fellow), Dr. Chris Leffler (Occ/Env Med Fellow), Dr. Ronald Dykeman (Occ/Env Med Fellow), Dr. Uma Dhanabalan (Occ/Env Med Fellow), Dr. Hsien-Wen Hsu (Occ/Env Med Fellow), Dr. Betty Ann Cohen (Occ/Env Med Fellow), Dr. Arvin Chin (Occ/Env Med Fellow), Dr. Daniel Rhodes (Occ/Env Med Fellow), Dr. Richard Wittman (Occ/Env Med Fellow), Dr. Sun-Dong Lee (Visiting Scientist from Sangji University, Korea), Dr. Ronald Green (Occ/Env Med Fellow), Dr. Erma Lawson (Environmental Health Fellow), Dr. Marc Weisskopf (Environmental Health Fellow), Dr. Bridget Bagert (Occ/Env Med Fellow), Dr. John Jarrell (Visiting Scientist from University of Calgary), Dr. Jennifer Weuve (Environmental Health Fellow), Dr. Karen Chou (Visiting Scientist from Michigan State), Dr. Nitin Jain (Channing Laboratory Fellow), Dr. Adrienne Ettinger (Children's Center Scientist), Dr. Sam Myers (Fellow in Alternative and Complementary Medicine), Dr. Marcelo Targino (Occ/Env Med Fellow), Dr. Manish Arora (Post-doctoral fellow from University of Sydney), Dr. Huiling Nie (Post-doctoral fellow from McMaster University).

Other faculty mentorship:

Elizabeth Rubinstein (HMS Summer research), Alicia Marier (HMS Summer research), Vanitha Janakiraman (HMS Summer research), Young-Sook Lim (Harvard College Summer research), Charles Lin (Harvard College Senior thesis research), Ed Hsieh (Harvard College Summer research), Naveen Thomas (Emory University Medical School Senior thesis research), Shreekrishna Akilesh (Harvard Dental School summer research), Christine Pace (HMS Summer research)

Advisory and supervisory responsibilities

1985-1987 Attending Physician, outpatient general medicine clinic, Boston City Hospital; weekly precepting for housestaff and medical students

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- 1990-2006 Preceptor, Residency in Occupational and Environmental Medicine, Harvard School of Public Health at the Mass Respiratory Hospital
- 1990-2006 Advisor to general M.P.H. students, Harvard School of Public Health.

2. LOCAL CONTRIBUTIONS (at the University of Michigan, 2006-2012)

- 2006- Principles of Environmental Health (EHS-500)
Course director and lecturer
- 2006- Environmental Epidemiology (EHS-608)
Guest lecturer on birth cohorts and environmental epidemiology
- 2006- Occupational and Environmental Disease (EHS-501)
Guest lecturer on metals exposure and health effects; Course Director (2009-)
- 2007- Metals Exposure, Biomarkers and Toxicity: A Multi-disciplinary Environmental Epidemiology Approach (EHS-698 reading course)
Course director and lecturer
- 2008-2009, Topics in Environmental Health Sciences (EHS-688)
2010-2011 Course director and lecturer
- 2009 Occupational and Environmental Disease (EHS-501)
Course director and lecturer
- 2009- On-line (Long-distance Foundations in Public Health Certificate Program): Principles of Environmental Health (EHS-500-801)
Course director and lecturer
- 2009 Introduction to Public Health (HMP-200)
Guest lecturer on environmental health
- 2009- Seminars in Aging and Public Health (EPID 813)
Course director and lecturer
- 2011 Seminar on Public Health in China (HMP-xxx)
Guest lecturer on "Environmental Health in China"

Post-doctoral fellow mentor:

Dr. Sung Kyun Park (Environmental Health Sciences Fellow, now Research Assistant Professor), Dr. Brisa Sanchez (Biostatistics Research Assistant Professor, now Assistant Professor), Dr. Richard Pilsner (Robert Wood Johnson Health & Society Fellow), Dr. Aimin Zhang (Environmental Health Sciences Fellow, Toxicology Training Grant), Dr. Ananya Roy (Environmental Health Sciences Fellow), Dr. David Cantonwine (Reproductive Sciences Fellow).

Doctoral Student Advisor (principal)

- | | |
|------------------|---|
| David Cantonwine | Ph.D. Environmental Health Sciences (2009) |
| Myriam Afeiche | Ph.D. Environmental Health Sciences (co-mentor with Karen Peterson; 2010) |
| Yoon-Hyeong Choi | Ph.D. Environmental Health Sciences (co-mentor with Sung Kyun Park; 2011) |

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Katie F. Bush	Ph.D. Environmental Health Sciences (co-mentor with Marie O'Neill; 2011)
Kelly Bakulski	Ph.D. Environmental Health Sciences (2012)
Gamola Fortenberry	Ph.D. Environmental Health Sciences (co-mentor with John Meeker; 2013)
Siying Huang	Ph.D. Environmental Health Sciences (2013)
Deena Thomas	Ph.D. Environmental Health Sciences (2014)
Rebecca Tutino	Ph.D. Environmental Health Sciences (2015)
Zishaan Farooqui	Ph.D. MD-PhD Medical Scientist Training Program (2015)

Masters Student Thesis Advisor

Bradley Lampe (OEE), Troy Meissner (OEE), Pheba Alexander (OEE), Brian Davis (OEE & HBHE), Aaron Leftwich (OJOC program), Suengwon Lee (Nutrition), Allen Zhong (OEE), Graham Newman (OEE), Jacqueline Barkoski (OEE)

Undergraduate Thesis Advisor

Lauren Schwartz (Neuroscience, LSA)

3. LOCAL CONTRIBUTIONS (at the University of Toronto, 2012-present)

2012	Determinants of Community Health (Faculty of Medicine) Guest lecturer on 'The Future of Medicine & Public Health in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World'.
2012-	CHL5004H Introduction to Public Health Guest lecturer on "The Future of Public Health (and Your Role !) in a Hot, Flat, Crowded...and Diverse, Aging, Stratified, Urbanized, Polluted, Thirsty, Hungry, Debt-Ridden World". "What is Public Health?", "Climate Change and Health"
2012-	CHL 5912F Industrial Toxicology. Guest lecturer on the "Toxicology of Metals".
2013-2014	Department of Family & Community Medicine "Building Blocks" (short course for International post-graduate primary care trainees); Guest lecturer on "Public Health & Primary Care"
2013-	CHL5701H Doctoral Seminar, Collaborative Doctoral Program in Global Health Guest lecturer on "The Challenges of Environmental Health in a Rapidly-Changing World, from the Molecular to the Global".
2014	JCR1000 "Interdisciplinary Approach to Global Challenges" Guest lecturer on "Global Environmental Health"
2014-	PHS100H1 "Grand Opportunities in Global Health"; Guest lecturer on "Urban Environments"
2015	Public Health & Preventive Medicine Residency Rounds "Physicians, Climate, and other Global Environmental Changes: Our Role"
2016	<u>CHL5004H Introduction to Public Health, Course Co-Director (with Professor Erica</u>

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- 2016 DiRuggiero)
CHL 7001H F6 Environmental-Molecular Epidemiology, Course Co-Moderator (with Professor Morteza Bashash)
- 2016 CHL5701H Doctoral Seminar, Collaborative Doctoral Program in Global Health, Course Co-Director (with Professors Erica DiRuggiero and Abdallah Daar)
- 2016 Joint Seminar, “The Impact on Intelligence, Behaviour, and Society of Lead Exposure: A Case Study of a Global Pollutant and On-going Research”; Collaborative Program in Neurosciences and Collaborative Global Health Doctoral Program, University of Toronto
- 2016 CHL5420H “Global Health Research Methods”
 Guest lecturer on “The Early Life Exposures in Mexico to Environmental Toxicants Project (ELEMENT): A Global Health Collaboration Case Study”

Masters student research advisor

Maele Marchand

Doctoral student advisor

Adele Carty

Doctoral student thesis committee member

Laura Bogaert

Doctoral student thesis examination committee member

Claudie CY Wong (doctoral student in epidemiology, Jockey School of Public Health and Primary Care, Chinese University of Hong Kong)

Zilong Zhang (doctoral student in epidemiology, Jockey School of Public Health and Primary Care, Chinese University of Hong Kong)

Post-doctoral fellow mentor:

Siyang Huang, Ph.D.; Morteza Bashash, Ph.D.; Roman Pabayo, Sc.D. (Harvard School of Public Health); Tripler Pell, M.D., M.P.H.

4. LOCAL CONTRIBUTIONS (at the University of Washington, 2017-present)

Doctoral student thesis research mentor

Megan Suter

Doctoral student special projects advisor

Rachel Shaffer

Joey Frostad

Rebecca De Buen

5. NIH K-grant mentorship:

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Robert Wright, M.D., M.P.H. (K-23 ES000381, “*Neurochemical and Genetic Markers of Lead Toxicity*”), 2000-2005; Dr. Wright is now Prof of Pediatrics, Mt. Sinai School of Medicine
 Marc Weisskopf, Ph.D. (K-01 ES012653, “*New Biomarkers of Neurotoxicity*”), 2004-2009; Dr. Weisskopf is now Associate Prof of Occup Health, Harvard Sch Public Health
 Sung Kyun Park, Sc.D. (K-01 ES016587; “*Environment, Novel Aging Outcomes, and Genetics*”), 2009-2014; Dr. Park is now Assistant Prof, Department of Epidemiology, University of Michigan Sch Public Health
 Emily Somers, Ph.D. (K-01 ES019909; “*Immune Dysfunction Associated with Early Life Heavy Metals Exposure*”), 2011-2016; Dr. Somers is now Associate Prof, Division of Rheumatology, Department of Internal Medicine, University of Michigan Medical School

COMMITTEE, ORGANIZATIONAL, AND VOLUNTEER SERVICE

National/International

1978-1982 Taskforce on Occupational and Environmental Health, Co-coordinator, Am Med Stu Assoc
 1989 Ad Hoc Study Committee, National Institute for Environmental Health Sciences Council
 1989-2006 Association of Occupational and Environmental Medicine Clinics (AOEC)-- (through the Northeast Specialty Hospital Center for Occupational and Environmental Medicine)
 1989-1990 Member, Relative Risk Reduction Strategies Committee, Science Advisory Board, U.S. Environmental Protection Agency
 1989-1992 Member, Board of Directors, Physicians for Human Rights, Boston, MA
 1991 National Institutes of Health, General Clinical Research Center Program, Site Visit Team
 1992- Member, National Advisory Committee, Physicians for Human Rights, Boston, MA
 1992 Special Study Section member (R3/S1/B3), National Institutes of Health
 1994 Ad Hoc Reviewer, National Institutes of Health, General Dental Research Center Program
 1994- Advisory Board, Institute for Energy and Environmental Research
 1994-1996 Associate, Project on Global Environmental Change and Health, Physicians for Social Responsibility
 1995 Ad Hoc Reviewer, National Institutes of Health, Diagnostic Radiology Study Section
 1996- Membor, Editorial Board, Health and Human Rights—an International Journal
 1995-1998 Advisory Committee, Consortium for Environmental Education in Medicine, Cambridge, MA.
 1996-1997 Reviewer, Agency for Toxic Substances and Disease Registry
 1997-1998 Program Committee, Annual Mtg, NIEHS Superfund Basic Research Group Centers
 1998-2013 (Founding) Medical Editor (1998-2004); Associated Medical Editor (2004-), Environmental Health Perspectives (official journal of NIEHS)
 2001 Ad Hoc Reviewer, National Institutes of Health, R-13 applications

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- 2002-2006 External Advisory Committee, Program Project on Lead and Osteoporosis, University of Rochester
- 2003-2005 Member, Ad-Hoc Expert Panel to Form Medical Management Guidelines for Lead-Exposed Adults, (supported by NIOSH and AOEC)
- 2003-2009 Member, Working Group on Lead and Pregnancy, Advisory Committee on Childhood Lead Poisoning Prevention, U.S. Centers for Disease Control and Prevention
- 2004 Ad Hoc Reviewer, National Institutes of Health, K-23 applications
- 2004 Ad Hoc Reviewer, Draft of "Immunization Safety Review: Vaccines and Autism" Immunization Safety Review Committee, Institute of Medicine, National Academies of Science
- 2004 Finalist (one of 8), Search for Director, National Institute for Environmental Health Sciences, U.S. National Institutes of Health
- 2005 Member, Strategic Planning Conference, National Institute for Environmental Health Sciences, Research Triangle Park, NC
- 2006 Ad Hoc Reviewer, Draft of "Preterm Birth: Causes, Consequence, and Prevention" Committee on Understanding Premature Birth and Assuring Health Outcomes, Institute of Medicine, National Academies of Science
- 2006 Member, External Advisory Committee, NIEHS Center, University of Rochester
- 2007 Member, Ad Hoc Study Section, Special Emphasis Panel/Scientific Review Group 2007/05 ZES1 JAB-C (DI) (NIEHS Discover Centers)
- 2007-2010 Member, Board on Population Health and Public Health Practice, Institute of Medicine, National Academies, Washington DC.
- 2007 Member, Ad Hoc Review Panel, Centers of Excellence Program, Swedish Council for Working Life and Social Research.
- 2007-2008 Member, Search Committee for Director of Extramural Research, NIEHS
- 2007 Special Consultant, Ad Hoc Study Section, Special Emphasis Panel/Scientific Review Group 2008/01 ZAR1 CHW-G (NIAMS Arthritis Centers)
- 2008 Report Reviewer, Draft National Research Council Report, "The National Children's Study Research Plan: A Review", National Academies
- 2008 Report Reviewer, Draft National Research Council Report, "Gulf War and Health: Updated Literature Review of Depleted Uranium", Institute of Medicine, National Academies
- 2008-2009 Data Safety Monitoring Board, "d-Penicillamine Chelation in lead-poisoned Children—A Phase II/III Trial" (R01FD003361; PI: Michael Shannon)
- 2008 Subcommittee to review Draft Report on Bisphenol A, Science Board, Food and Drug Administration
- 2008 Planning Committee, International Symposium on the Environmental and Health Consequences of Metal Mining and Smelting
- 2008-2009 Co-Chair, Planning Committee, "Climate Change Impacts on Public Health in India", Workshop that took place in Goa, India in Aug-Sept 2009 co-sponsored by UM Center for Global Health, the US Centers for Disease Control and Prevention and the Indian Council for Medical Research

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- 2008 Finalist (one of 2), Search for Director, National Institute for Environmental Health Sciences, U.S. National Institutes of Health
- 2009-2012 Member, Board on Environmental Studies and Toxicology, National Research Council
- 2009 Reviewer, NIH Challenge Grants, Special Emphasis Panel/Scientific Review Group 2009/10 ZRG1 GGG-F
- 2009-2010 External Member, Academic Program Review Site Visit Committee, Department of Environmental and Occupational Health Sciences, University of Washington School of Public Health
- 2010-2012 Member, External Advisory Committee, University of Rochester NIEHS P30 Core Center
- 2010 Member, Ad-hoc review committee, National Health Research Institutes of Taiwan, Special Emphasis Panel—NHRI-Kaoshiung Medical College Program Project on “: “Gene Environment Interaction in the Genesis of Asthma and Allergic Diseases”
- 2010-2012 Member, Advisory Board, Institute of Public Health, Florida Agricultural & Mechanical University, Tallahassee, FL
- 2011 Reviewer, NIEHS Career Development Awards, Special Emphasis Panel/Scientific Review Group 2011/05 ZES1 LKB-J (K9)
- 2011-2016 Member, NIEHS National Advisory Environmental Health Sciences Council
- 2012 Member, Editorial Board, Journal of Alzheimer’s Disease
- 2015 Member and External Reviewer, School of Population and Public Health Review Committee, University of British Columbia, Vancouver, B.C.
- 2016- Chair, Board of Directors, Canadian Urban Environmental Health Research Consortium, (National Consortium based out of the Dalla Lana School of Public Health)
- 2017- Member, Energy Research Committee, Health Effects Institute, Boston, MA
- 2017-2018 Executive Co-Chair, Workshop on the Global Burden of Disease-Pollution and Health Initiative, March 1-2, 2018, Institute for Health Metrics and Evaluation, Seattle, WA
- 2017- Executive Co-Leader, Global Burden of Disease-Pollution and Health Initiative
- 2019- Member, Research Advisory Committee, Centre of Environmental Health, The Public Health Foundation of India and the Tata Institute of Social Sciences, New Delhi, India
- 2019- Reviewer, draft report on trace metals levels in pregnancy women, Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention, Atlanta

Regional

- 1988-1990 Health Facilities Appeals Board, Member, Dept. Public Health, Comm. Of Mass.
- 1988-2006 Advisory Board, Massachusetts Department of Public Health, Sentinel Event Notification System for Occupational Risks (SENSOR) Project
- 1989-1995 Advisory Board, Massachusetts Division of Occupational Hygiene, Lead Registry Project
- 1990-1992 Board of Directors, Member, Health Care for All, Boston, Massachusetts
- 1993-1995 Faculty Council, Member, Harvard School of Public Health
- 1995-2006 Faculty Advisory Committee, Public Health Practice Program, Harvard School of Public Health

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1996-2006 Advisory Board, Boston VA Environmental Hazards Center, Boston

1997-2001 Faculty Steering Committee, Center for Children's Health, Harvard School of Public Health

1996-2006 Senior Epidemiology Consultant, Massachusetts Veterans Epidemiology Research and Information Center, Boston.

1996-2006 Associate, Center for Health and the Global Environment, Harvard Medical School

1997-2002 Faculty Advisory Committee on Continuing Professional Education, Harvard School of Public Health

1998-2006 Faculty Steering Committee, Masters of Public Health program, Harvard School of Public Health

2001-2003 Board of Directors, New England College of Occupational and Environmental Medicine

2001-2006 Associate Director, Harvard NIEHS Environmental Sciences Center, Harvard School of Public Health

2001-2006 Senior Advisory Council Member, Lowell Center for Sustainable Production, University of Massachusetts, Lowell, MA

2003-2006 Member, Human Subjects Committee, Harvard School of Public Health

2003-2006 Advisory Committee, Occupational Health Services Research Program, Harvard School of Public Health

2006 Study Section Review Committee, Pilot Project Program, Graham Environmental Sustainability Institute, School of Natural Resources and Environment, University of Michigan

2006-2007 Chair, Planning Committee, Health Sector, May 8-10, 2007 National Summit on Coping with Climate Change, University of Michigan

2007-2009 Member, Advisory Committee, SPH Practice Committee, University of Michigan School of Public Health

2007-2012 Member, Residency Advisory Committee, General Preventive Medicine Residency, University of Michigan School of Public Health

2008-2009 Member, Steering Committee, NIA T32 Training Grant on Aging Research (PI: Mary Haan), University of Michigan School of Public Health

2008-2013 Member, Advisory Committee, Outstanding New Environmental Scientist Awardee (Marie O'Neill), NIEHS

2008-2009 Member, Search Committee for Director of the Risk Science Center, University of Michigan School of Public Health

2009 Co-Chair, Planning Committee, Workshop on Predicting and Preventing Climate Change Impacts on Public Health, Goa, India (Collaboration with the UM Center for Global Health, the US Centers for Disease Control and Prevention, and the Indian Council for Medical Research)

2009-2011 Director and PI, NIA T32 Training Grant on Aging Research, University of Michigan School of Public Health

2009-2010 Member, Planning Committee, University Research Corridor (U of M, Michigan State, Wayne State) symposium on environmental health sciences in January 2010

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2009-2012 Faculty Associate, Center for Global Health, University of Michigan
 2009-2012 Member, Internal Advisory Board, Cancer Epidemiology Education in Special Populations Program, University of Michigan School of Public Health
 2009-2011 Chair, Steering Committee on Global Health, University of Michigan School of Public Health
 2010-2012 Member, Executive Committee, Graham Environmental Sustainability Institute, University Of Michigan
 2010-2012 Member, Committee on Diversity, University of Michigan School of Public Health
 2012-2017 Chair, Executive Committee, Dalla Lana School of Public Health, University of Toronto
 2012-2017 Chair, Tenure Committee, Dalla Lana School of Public Health, University of Toronto
 2012-2017 Chair, Decanal Promotions Committee, Dalla Lana School of Public Health, University of Toronto
 2012-2017 Chair, Executive Advisory Committee, Institute for Global Health Equity & Innovation, Dalla Lana School of Public Health, University of Toronto
 2013-2015 Interim Director, Institute for Global Health Equity & Innovation, Dalla Lana School of Public Health, University of Toronto
 2013-2014 Co-Chair, Research Committee, Dalla Lana School of Public Health, University of Toronto
 2014-2017 Chair, Executive Advisory Committee, Institute for Health Policy Management and Evaluation, University of Toronto
 2014 Chair, Ad-hoc Committee to create an Institute for Indigenous Health (based on a \$10 million endowment gift made to DLSPH), Dalla Lana School of Public Health, University of Toronto; Chair, Executive Advisory Committee beginning 2015
 2015-2017 Chair, Executive Advisory Committee, Joint Centre for Bioethics, University of Toronto
 2015- Chair (2015-2017); Member (2017-present), Taskforce on Environmental Health, Ministry of Health and Longterm Care, Province of Ontario
 2016-2017 Chair, Executive Advisory Committee, Centre for Critical Qualitative Health Research, University of Toronto
 2017-2018 Executive Co-Chair, Workshop on the Global Burden of Disease-Pollution and Health Initiative (a collaboration between the Global Alliance on Health and Pollution and the Institute for Health Metrics), Seattle, WA

Hospital

1982-1985 Occupational Safety and Health Committee, Member, Boston City Hospital, Boston
 1983-1984 House Officers Association, Treasurer, Boston City Hospital
 1984-1985 House Officers Association, Co-President, Boston City Hospital

OTHER PUBLIC SERVICE

1987 Member, Fact-finding tour on "The Health Effects of Massive Exposure to Tear Gas",

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- Seoul, South Korea, July 11-18 (Sponsored by Physicians for Human Rights, American College of Physicians)
- 1988 Member, Fact-finding tour on "Chemical Weapons and the Iraqi Kurdish refugees", Turkey Oct 6-16 (Sponsored by Physician for Human Rights and the MacArthur Foundation)
- 1990 Leader, Fact-finding tour on "Health and Human Rights in Burma (Myanmar)", Thailand-Burma Dec. 26-Jan 6 (Sponsored by Physician for Human Rights and the MacArthur Foundation)
- 2009 Consultant and senior advisor, Fact-finding tour on "Mining and Potential Exposures and Health Effects in Guatemala", August 2009 (Sponsored by Physicians for Human Rights)

CONSULTING POSITIONS

- 1987-1989 Consultant, "In-Vivo Total Body Lead Analysis by X-Ray Fluorescence", NIH/SBIR Grant 2R44ES03918-02
- 1988-1989 Consultant, "Boston Area Health Coalition Demonstration Project", DHHS/MP000003-A1
- 1993-1995 Consultant, Employee Health Services, Brigham and Women's Hospital
- 1994 Consultant, Public Welfare Foundation, Washington, DC (review of Environmental Programs)
- 1997-2006 Consultant, Pediatric Environmental Health Center, Children's Hospital, Boston, MA
- 2000 Consultant, Doris Duke Foundation, New York, NY (review of potential Environment and Medicine programs)
- 2009-2010 Consultant and Member, Academic Program Review Site Visit Committee, Department of Environmental and Occupational Health Sciences, University of Washington School of Public Health, Seattle, WA
- 2011 Consultant, JPB Foundation, New York, NY (review of Environmental Health programs)
- 2014- Advisor, Hearing Health Sciences, Ann Arbor MI and Amsterdam, Netherlands

VISITING PROFESSORSHIPS

- 1997 Alice Hamilton Visiting Professor, University of California at San Francisco
- 2000-2001 Visiting Professor, Sri Ramachandra Medical College & Research Institute, Chennai, India
- 2004 Visiting Professor, Department of Environmental Medicine, University of Rochester
- 2013 Visiting Professor, Shanghai Key Laboratory, Shanghai Jiao-Tung University

SEMINARS AND EXTRAMURAL INVITED PRESENTATIONS (last 15 years, since 2003; prior presentations upon request)

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- 2003 Guest lecturer, "Lead as a trans-generational toxin", Seminar series, Department of OB/GYN, Brigham and Women's Hospital
- 2003 Plenary speaker, "Clinical opportunities in environmental health", Annual Leadership Retreat, National Institute for Environmental Health Sciences, Greensboro, NC.
- 2003 Discussant, "Uncontrolled Hypertension in a Painter", Grand Rounds in Occupational/Environmental Medicine, Harvard School of Public Health
- 2003 Discussant, "A 53-Year Old Teacher with Chemical Sensitivities", Grand Rounds in Occupational/Environmental Medicine, Harvard School of Public Health
- 2003 Lecturer, "Pestilence and Progress: The Future of Public Health through the Lens of Blood", Center for Blood Research Symposium, Museum of Science, Boston, MA.
- 2003 Speaker, "Bones, Genes, Plasma, and Lead: New Frontiers in Understanding the Toxicity of an Old Hazard", Distinguished Lecture Series. National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention, Atlanta GA.
- 2003 Plenary speaker, "Biomarkers, Genes, Interactions and Lead: New Insights from Research on an Old Hazard", Superfund Basic Research Program Annual Meeting, Dartmouth University, Hanover, NH.
- 2003 Special Lecturer, "Lead Exposure and Chronic Disease: Recent Research on Susceptible Sub-populations", Florida Agricultural and Mechanical University, Tallahassee, FL.
- 2004 Speaker, "New Frontiers in Understanding the Toxicity of Lead", Department of Environmental Medicine, University of Rochester, Rochester, NY.
- 2004 Presenter, "Lead Exposure During Pregnancy: Mobilization of Maternal Bone Lead Stores and Their Threat to the Fetus", Semi-annual meeting of the Childhood Lead Poisoning Prevention Branch, Centers for Disease Control and Prevention, Baltimore, MD
- 2004 Presenter, "Environmental Medicine", Annual meeting of the Editorial Board, *Environmental Health Perspectives*, Baltimore MD
- 2004 Plenary speaker, "Metals, Genes, and Neurodegeneration: the Approach of the Metals Epidemiology Research Group at the Harvard School of Public Health", National Institute for Environmental Health Sciences Conference on Neurodegeneration.
- 2004 Discussant, "Suspected Lead Toxicity" Grand Rounds in Occupational/Environmental Medicine, Harvard School of Public Health
- 2004 Discussant, "Mercury Exposure in a Metal Worker", Grand Rounds in Occupational/Environmental Medicine, Harvard School of Public Health
- 2004 Presenter, "Effects of Our Environment on Intellect, Behavior, Life and Death," Leadership Council meeting, Harvard School of Public Health
- 2004 Guest Speaker, "Biomarkers, Genes, Interactions and Lead: New Insights from Research on an Old Hazard", Department of Environmental Health, University of Michigan School of Public Health
- 2004 Guest Speaker, "Medicine, Public Health, and the Great American Melting Pot: A Second-Generation Chinese-American Reflects on His Personal Odyssey", Sponsored by the Asian Student Association, Harvard School of Public Health
- 2004 Speaker, "Aging, the Environment and Genetics: Recent Insights from

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- Epidemiologic Studies of Environmental Lead Exposure”, Annual Leadership Retreat, National Institute for Environmental Health Sciences, Pinehurst, NC.
- 2004 Plenary Speaker, “Guidelines for the Management of Lead-Exposed Adults: Recommendations by a National Expert Panel Based on Recent Research”, New England College of Occupational and Environmental Medicine Annual Meeting
- 2005 Lecturer, “Biomarkers, Genes, Interactions and Lead: New Insights from Research on an Old Hazard”, Sri Ramachandra Medical College and Research Institute, Chennai, Tamil Nadu, India
- 2005 Lecturer, “Your Child's IQ, Behavior and Neuropathology: Genes or Environment?”, the Harvard Club of Boston, Boston, MA
- 2005 Guest Speaker, “Metals, Neurodevelopment, and Neurodegeneration: The Work of the Metals Epidemiology Research Group at HSPH”, Neurostatistics Working Group, Harvard School of Public Health, Boston, MA.
- 2005 Plenary Speaker, “Aging, the Environment and Genetics: Recent Insights from Epidemiologic Cohort Studies of Environmental Lead Exposure”, NIEHS Symposium on Aging and the Environment, Duke University, Durham, NC.
- 2005 Plenary Speaker, “SPECT Imaging and Chemical Intolerance”, NIEHS/NIAA symposium on “Chemical Intolerance and Addiction: a Shared Etiology?”, Research Triangle Park, NC
- 2005 Workshop Presenter, “Social and Environmental Threats: the Unnecessary Epidemics”, Harvard School of Public Health Leadership Council Annual Conference, Boston, MA
- 2005 Keynote Speaker, “Our Food, Our Water, Our Homes: Toxic Metals”, The Boston Foundation, Boston, MA.
- 2006 Invited Speaker (invited by David Schwartz, NIEHS Director), “Goal IV: Improve and Expand Community-Linked Research”, Roundtable on Environmental Health Sciences, Research, and Medicine; Institute of Medicine, National Academy of Sciences, Wash DC.
- 2006 Speaker, “The Future of Environmental Health Sciences at the University of Michigan”, Dean’s Advisory Board, University of Michigan School of Public Health, Ann Arbor, MI
- 2006 Keynote Speaker and Harriett Hardy Annual Lecturer, “The ‘E’ in Occupational/Environmental Medicine: the Present and the Future”, New England College of Occupational Medicine Annual Meeting, New Bedford, MA
- 2007 Speaker, “The Future of Environmental Health Sciences at the University of Michigan”, Meetings of the UMSPH Alumni Council and the EHS Emeritus Faculty, Ann Arbor, MI
- 2007 Moderator and Speaker, “The Normative Aging Study: Health Effects of Lead”, Symposium on the Health Effects of Lead, 2007 Annual Meeting of the International Society for Environmental Epidemiology, Mexico City, Sept 8, 2007
- 2007 Guest Lecture, “Uncovering the Impact of the Environment on Disease: Big Opportunities for Physician-Scientists”, Medical Scientist Training Program, University of Michigan Medical School
- 2007 Guest Lecture, “Industrialization, Pollution and Public Health in India: Can India Survive Modernization?”, Osher Institute, Ann Arbor, MI
- 2007 Plenary Speaker, “Environmental Equity: Local and Global Challenges and the Balance Between Research and Advocacy”, Michigan’s Premier Public Health Conference,

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- October 16, 2007, Dearborn, MI
- 2007 Board Member Lecture, "Metals, Genes, Health and Human Rights: from the Molecular to the Global", Fall Meeting of the Board of Population Health and Public Health Practice, Institute of Medicine, National Academies of Science, Washington DC, Dec 13, 2007.
- 2008 Speaker, "MDs as Leaders for Change in Environmentalism", 2008 Annual Regional Political Leadership Institute, American Medical Student Association, University of Michigan Medical School, February 16, 2008
- 2008 Speaker, Grand Rounds, "The Impact of Environmental Pollutants on Disease: New Insights and Implications for Research and Medical Practice" Department of Medicine, University of Michigan Health System.
- 2008 Guest Lecture, "Emerging Insights into the Pervasive Influence of Environment Toxicants on Reproductive Outcomes and Offspring Development: Lead as a Case Study", Reproductive Sciences Program, University of Michigan
- 2008 Panelist, "Environmental Health in China", Public Health Grand Rounds, Division of Health Practice, University of Michigan School of Public Health
- 2008 Keynote Speaker, "Human Health and the Role of Water", Symposium on Water, Health & The Environment, Graham Environmental Sustainability Institute, University of Michigan
- 2008 Guest Speaker, "Lead Exposure and Toxicity: New Insights Using Molecular Epidemiology" Wadsworth Laboratories and SUNY-Albany
- 2008 Speaker: "Impact of Climate Change on Human Health: Vulnerability" 5th AKKA World Kannada Conference, Chicago IL
- 2008 Speaker, "The 'E' in Occupational/Environmental Medicine: the Present and the Future", Michigan Occupational/Environmental Medicine Annual Meeting, Mackinac Island, MI
- 2008 Speaker, "Impact of Climate Change on Human Health", University of Michigan Chapter of the American Medical Student Association, Ann Arbor, MI
- 2008 Speaker, "Early Life Origins of Adult Chronic Disease: Environmental Health and Toxicology at a Crossroads" Michigan Chapter of the Society for Toxicology, Ann Arbor, MI
- 2009 Speaker, "Evidence for Lead as an Environmental Stressor of Alzheimer's Disease and the Role of Epigenetics", Symposium Panel, Annual Meeting of the Society for Toxicology, Baltimore, MD
- 2009 Keynote Speaker, "Lead, Late-Life and Early Life Effects, and the Emerging Field of Environmental Epigenetics: Looking Ahead", Annual Meeting of the American College for the Advancement of Medicine, San Diego, CA
- 2009 Speaker, "Lead Toxicity and Mechanistically-Oriented Molecular Epidemiology: Targeting the Epigenetics of Alzheimer's Disease", Seminar Series, Institute for Environmental Health Sciences, Wayne State University, Detroit, MI
- 2009 Speaker, "Climate Change Impacts on Health in the Developing World", Research Discussion Series, University of Michigan Center for Global Health
- 2009 Speaker, "Autism, Aggressive Behavior, Anxiety, and Alzheimer's: are Environmental Toxicants Playing a Major Etiologic Role?", Department of Psychology, University of Michigan
- 2009 Speaker, "Early Life Exposures and Endocrine Disruption: Evidence from Molecular

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- Epidemiology”, Pediatric Endocrine Seminar, University of Michigan Medical School
- 2009 Distinguished Speaker, “Lead Toxicity: Twenty Years of Research On The Poison That Keeps on Poisoning” 10th Anniversary of the Department of Microbiology and Environmental Toxicology, University of California at Santa Cruz
- 2010 Speaker, “The Centers for Disease Control and Prevention & the Environmental Protection Agency: Potential Funding Opportunities for Regional Collaboration in Michigan”, University Research Corridor Symposium on Environmental Health, Detroit, MI.
- 2010 Speaker, “The Future of Public Health”, University of Washington School of Public Health
- 2010 Speaker, “The Environment Meets the Epigenome: Is This Where Autoimmunity Begins?” Symposium on Autoimmunity and Epigenetics, University of Michigan
- 2010 Keynote Speaker, “A New Twist to an Old Story: The Evidence for Early Life Lead Exposure as a Risk Factor for Alzheimer's Disease through Epigenetic Programming”, NIEHS Environmental Health Sciences Center and Toxicology Training Program Retreat, University of Rochester, NY
- 2010 Speaker, “Lead Toxicity: Twenty Years of Research on The Poison That Keeps on Poisoning” and “Environmental Health Sciences at the University of Michigan”, Tianjin Centers for Disease Control, Tianjin, China
- 2010 Speaker, “Pediatric Lead Toxicity”, Xinhua Hospital and the Shanghai Jiao-Tung Medical University Department of Pediatrics, Shanghai, China
- 2010 Speaker, “Environmental Health Sciences at the University of Michigan”, Fudan University, Shanghai, China
- 2010 Speaker, “Alzheimer’s Disease, Epigenetics and the Environment”, Symposium Update, Alzheimer’s Disease Association, Ann Arbor, MI
- 2010 Speaker, “Environmental Justice, Progress (and the Lack Thereof) and the Role of Research”, Roundtable on Environmental Health Sciences, Research and Medicine, Institute of Medicine, National Academies, Washington DC.
- 2010 Speaker, “White Coats, Population Science and Poison Gas: A Life Spent at the Intersection of Academic Medicine, Global Health & Human Rights”, Robert Wood Johnson Clinical Fellows Program, University of Michigan Medical School, Ann Arbor, MI
- 2011 Speaker, “The Three Most Difficult Challenges to Molecular Epidemiologic Research on Gene-Environment Interactions: Lead Toxicity as a Case Study.” Department of Human Genetics, University of Michigan Medical School, Ann Arbor, MI
- 2011 Speaker, “The Integration of Data on Environmental Carcinogens with Population and Genetic Resources”, “Opportunities & Challenges for Translational Research on Cancer Prevention”, Translational Cancer Prevention & Biomarkers Workshop, Mazamdur-Shaw Cancer Center, Bangalore, India.
- 2011 Speaker, “Success in the Academy”, Faculty Panel, Students of Color of Rackham, Rackham Graduate School, University of Michigan
- 2011 Speaker, “White Coats, Population Science and Poison Gas: Fact-Finding Missions by Health Professionals for Human Rights”, Sujal Parikh Memorial Symposium, University of Michigan Medical School.
- 2011 Speaker, “The Analysis of Biomarker Data to Ascertain the Contribution of Environmental

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- Exposures to the Etiology of Disease: Lead Exposure and Toxicity as a Case Study”, Department of Computational Medicine and Bioinformatics, University of Michigan Medical School.
- 2012 Speaker, “Research and Analysis Linking Upstream and Downstream Disparities Work”, Webinar hosted by the Health & Environmental Funders Network, Bethesda, MD, with 52 Foundations related Health.
- 2012 Keynote Speaker, “The Future of Public Health & Medicine in a Crowded, Diverse, Stratified, Hot, Urbanized, Polluted, Thirsty, Hungry and Debt-Ridden World”. E.J. Van Liere Memorial Convocation and Health Sciences Center Research Day, West Virginia University, Morgantown, West Virginia
- 2012 Plenary Speaker, “Transgenerational Impacts of Pollutants on Offspring: Recent Insights and Case Studies”, Connaught Global Challenge International Symposium, University of Toronto.
- 2012 Speaker, “Environmental Impacts on Aging (+ an update on the Dalla Lana School of Public Health)”, Community Medicine Rounds, University of Toronto
- 2012 Speaker, “The Environment & Public Health in a Research-Intensive University: Opportunities for Scholarship in a Crowded, Diverse, Stratified, Hot, Urbanized, Polluted, Thirsty, Hungry and Debt-Ridden World”, School for the Environment, University of Toronto
- 2012 Speaker, “Big Public Health Challenges (& Opportunities) in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World”, External Advisory Meeting, Public Health Ontario, Toronto
- 2012 Speaker, “Canadian Public Health Schools (in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World): The View from Toronto, External Advisory Board Meeting, Institute for Population and Public Health, Canadian Institutes for Health Research, Toronto
- 2012 Speaker, “Sustainable Development and Health: The Global Mining Industry”, Canadian Society for International Health Annual Meeting, Ottawa
- 2012 Speaker, “Big Public Health Challenges (& Opportunities) in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World”, Xinhua Hospital/Shanghai Jiao-Tung University, Shanghai, China.
- 2012 Speaker, “The Impact of Population-Wide Lead Exposure and Gene-Lead Interactions on Chronic Disease”, Genetic Grand Rounds, Sick Kids Hospital, Toronto.
- 2012 Speaker, “Looking behind the curtain: Lead Toxicity as a Case Study of Methodologic Challenges in Gene-Environment Interactions Research”, Strategic Training in Advanced Genetic Epidemiology (STAGE), Dalla Lana School of Public Health, University of Toronto.
- 2012 Keynote speaker: “Public Health—the Next Frontier in Health Professions Education”. Council of Health Sciences annual retreat, University of Toronto.
- 2013 Speaker, “White Coats, Population Science and Poison Gas: Lessons from a Life Spent at the Intersection of Academic Medicine, Global Health & Human Rights”, Joint Center for Bioethics, University of Toronto
- 2013 Speaker, “Gauging environmental impact on the development of chronic inflammation”,

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- Connaught Global Challenge Workshop, University of Toronto.
- 2013 Speaker, “The Future of Public Health & Medicine in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World”, Grand Rounds, Department of Medicine, University of Toronto.
- 2013 Speaker, “Metals, Mega-trends, and Me: Reflections on Research and the Vision for the Dalla Lana SPH”, Occupational and Environmental Medicine Grand Rounds, St. Michael’s Hospital, Toronto, ON.
- 2013 Speaker, “Air pollution and Cardiovascular Disease: Health Impacts, Mechanisms, and Research Opportunities”, University of Toronto & FMUSP-InCor Symposium on Cardiology, Sao Paulo, Brazil.
- 2013 Speaker: “Lead Exposure’s Impact on Health and Policy: A History of Neglect and Missed Opportunities”, Public Health Policy Rounds, CIHR Strategic Training Program in Public Health Policy, University of Toronto.
- 2013 Speaker: “Lead Toxicity: The Long Tail of Health Impacts (and On-going Research Opportunities!) From an Historical Environmental Air Pollutant”, Southern Ontario Centre for Air Pollution and Aerosol Research, University of Toronto.
- 2013 Speaker: “Water and Sanitation”, Water, Sanitation and Hygiene (WASH) Canada, Toronto, Ontario, Canada
- 2014 Speaker: “Conflict and Public Health”, Ontario Medical Association, Toronto, Canada
- 2014 Panelist: “Judging Evidence: Finding a Place for Variation in an Evidence-Based World”, Health Quality Ontario, Toronto, Canada
- 2014 Speaker: “The Grand Convergence: Creating Health in a Globalized World”, Special meeting of the Canadian Chamber of Commerce in Shanghai
- 2014 Speaker: “The Grand Convergence: Creating Health in a Globalized World”, Jockey School of Public Health and Primary Care, Chinese University of Hong Kong, Hong Kong, China
- 2015 Speaker: “The Grand Convergence: Creating Health in a Globalized World”, School of Public Health and the ASEAN Institute, Mahidol University, Bangkok, Thailand
- 2015 Speaker: “Gene-environment Interactions and the Role of Big Data in Environmental Health” Seminar series, School of the Environment, University of Toronto, Toronto, Canada
- 2015 Speaker: “Global Health Security”, Ill with Illness—Economic, Social & Security Barriers to the Provision of Global Health, Munk School of Global Affairs, University of Toronto, Toronto, Canada
- 2015 Speaker: “The Dalla Lana School of Public Health: Big Ideas and Initiatives for Creating Health in a Globalized World”, Speaker Series, University of Toronto Alumni of Toronto.
- 2015 Speaker: “Unique Scientific Opportunities for the Precision Medicine Initiative National Research Cohort: Exposomics, Data Linkage, and Global Collaborations”. Working group on President Obama’s Precision Medicine Initiative (Chaired by Francis Collins, Director, NIH)
- 2015 Speaker: “What is the Role of Schools of Public Health in the 21st Century?” 50th Anniversary Celebration of the Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montreal, Quebec.
- 2015 Welcoming Address: “Global Public Health and Mental Health”, Going Global for Mental Health conference, Centre for Addictions and Mental Health/Department of Psychiatry/Dalla

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- Lana School of Public Health, Toronto, ON
- 2015 John Goldsmith Memorial Lecture: “Big Data, Environmental (and Social) Epidemiology, Power and Politics”, Opening Plenary Session, International Society for Environmental Epidemiology Annual Meeting, Sao Paulo, Brazil
 - 2015 Inaugural Speaker: “The Future of Public Health and Medicine in a Crowded and Complex World”, Global Health Leadership Series, PSG Medical School & the Shanti Ashram Foundation, Coimbatore, Tamil Nadu, India
 - 2016 Speaker “The Future of Public Health & Medicine in a Crowded, Diverse, Aging, Stratified, Urbanized, Polluted, Hot, Thirsty, Hungry, Debt-Ridden World”, Indian Institutes of Public Health—Hyderabad, Hyderabad, India
 - 2016 Speaker: “Integration of Public Health & Health Care: The Unmet Agenda for a Truly Sustainable Health System”, Board of Directors Retreat, Toronto East General Hospital, Toronto
 - 2016 Plenary speaker: “Health Promotion, Prevention and Health Protection: Innovative Initiatives”, 6th Asia-Pacific Conference on Public Health | 1st ASEAN Health Promotion Conference Bangkok, August
 - 2016 Speaker: “Big Data, Environmental (and Social) Epidemiology, Power and Politics”, Mount Sinai School of Medicine, New York, NY
 - 2016 Plenary Speaker: “The Impact of Environmental Toxicants on Health: Recent Epidemiologic Approaches & Advances”, International College of Integrative Medicine Annual Meeting, Toronto, ON
 - 2016 Plenary Speaker: “Big Data and Implications for Environmental Health”, 15th Anniversary Conference, Jockey Club School of Public Health & Primary Care, Chinese University of Hong Kong, Hong Kong
 - 2016 Plenary Speaker: “Innovations in Assessing Lead Poisoning and Child Health: Policy & Clinical Implications”, Chinese University of Hong Kong-Fudan-Oxford International Symposium on Health Impacts of Environmental Exposures”, Hong Kong
 - 2016 Speaker: “Addressing a Changing Environment (and Impacts on Health, AKA Can India Survive Modernization?)”, Indian Institutes of Technology Alumni, Canada, International Conference 2016, Toronto.
 - 2016 Plenary Speaker, “Hidradenitis Suppurativa: Research Directions from a Population Health Perspective”, Symposium on Hidradenitis Suppurativa Advances, Toronto.
 - 2016 Plenary Speaker, “Children’s Environmental Health”, The 2016 Annual National Conference on Children’s Healthcare, Shanghai, China
 - 2016 Special Guest Speaker, “Big Data, Environmental (and Social) Epidemiology, Power and Politics”, Shanghai Municipal Center for Disease Control, Shanghai, China
 - 2016 Lecturer, “Lead and Human Health: Recent Research and Associated Lessons for Science & Policy”, Fudan University School of Public Health, Shanghai, China
 - 2017 Lecturer, “The Impact of Environmental Toxicants on Health: Recent Epidemiologic Approaches & Advances”, Saw Swee Hock School of Public Health, National University of Singapore, Singapore
 - 2017 Lecturer, “The Future of Academic Public Health”, Saw Swee Hock School of Public Health,

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- National University of Singapore, Singapore
- 2017 Lecturer, “Recent Advances in Understanding, Preventing, and Reversing the Impact of Environmental Factors on Health”, Society of Chinese Bioscientists in America, Li Ka Shing Knowledge Institute, St. Michael’s Hospital, Toronto, ON
- 2017 Lecturer, “Environmental Epidemiology in the Era of Exposomics, Lifecourse Epidemiology, Big Data and Big Science”, Department of Environmental Health, Harvard School of Public Health, Boston, MA
- 2017 Speaker, “The Role of a Re-emergent Canadian School of Public Health in a Hot, Hungry, Polluted, Aging, Polarized World Prone to Pandemics, Chronic Disease, and Unsustainable Health Systems”, Royal Canadian Institute for Science, Toronto, ON
- 2017 Speaker, “The Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) Birth Cohort Study: Current Research on Fluoride and Neurodevelopment”, Seminar Series in Environmental Epidemiology, University of Washington School of Public Health, Seattle, WA
- 2017 Plenary Speaker: “New realities arising from the extractive industries and agri-business: the Pollution and health perspective,” Hong Kong Summit of Global Health Leaders. University of Hong Kong, Hong Kong
- 2018 Plenary Speaker: “The GBD-Pollution and Health Initiative: Challenges & Opportunities”, Workshop on the Global Burden of Disease-Pollution and Health Initiative, Institute for Health Metrics, University of Washington, Seattle, WA
- 2018 Guest Lecturer: “Partnerships, Local Responsiveness, National and Global Impacts”, University of Iowa College of Public Health, Iowa City, IA
- 2018 Plenary Speaker: “Current Research on Fluoride and Neurodevelopment: The Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) Birth Cohort Study”, Annual meeting of the International Academy of Oral Medicine and Toxicology, Denver, CO
- 2018 Speaker, “Recent Epidemiologic Research on Lead Toxicity: New Surprises regarding an Old Global Pollutant”, Department of Environmental and Occupational Health Sciences Seminar Series, University of Washington School of Public Health, Seattle, WA
- 2018 Speaker: “The Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) Birth Cohort Study: Current Research on Fluoride and Neurodevelopment”, Symposium on Fluoride research, Annual meeting of the International Society for Environmental Epidemiology/International Society for Exposure Science, Ottawa, ON
- 2018 Panelist, “The Fluoridation Decision: Considering the Evidence for Benefits, Possible Risks as well as Ethical World Views”, Annual meeting of the International Society for Environmental Epidemiology/International Society for Exposure Science, Ottawa, ON
- 2018 Speaker: “Grand Opportunities”, The UC-Irvine School of Population Health and the Samueli College of Health Sciences, Irvine, CA
- 2018 Speaker, “The Global Burden of Disease-Pollution and Health Initiative”, Office of the Director and the Global Environmental Health Program, U.S. National Institute for Environmental Health Sciences, Research Triangle Park, NC
- 2019 Speaker, “Evaluating, treating and managing disabilities of patients with chemical intolerance”, Symposium on Chemical Intolerance—A Way Forward, Marilyn Brachman

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Hoffman Foundation and the Hoffman Program on Chemicals and Health at the Harvard T.H. Chan School of Public Health, Dallas, TX

2019 Guest Lecturer: “The Global Burden of Disease-Pollution and Health Initiative”, Center for Population Health Sciences, Stanford University, Palo Alto, CA

INVENTIONS/PATENTS: n/a

BIBLIOGRAPHY: (H-index, as of April, 2019, Google Scholar: 83)

Peer-reviewed journals

1. Hu H, Markowitz SB. A case-study of industrial bladder cancer. *Einstein Quarterly Review of Biology and Medicine* 1982;1:29-35.
2. Hu H. Benzene and myelofibrosis. *Annals of Internal Medicine* 1987;106:171-172
3. Hu H, Milder FL, Burger DE. X-Ray Fluorescence: Issues surrounding the application of a new tool for measuring burden of lead. *Environmental Research* 1989;49:295-317.
4. Hu H, Fine J, Epstein P, Kelsey K, Reynolds P, Walker B. Tear Gas: Harrassing agent or toxic chemical weapon? *JAMA* 1989;262:660-663.
5. Hu H, Cook-Deegan R, Shukri A. The use of chemical weapons: Conducting an investigation using survey epidemiology. *JAMA* 1989;262:640-643.
6. Hu H, Tosteson T, Aufderheide AC, Wittmers L, Burger DE, Milder FL, Schidlovsky G, Jones KW. Distribution of lead in human bone: I. Atomic absorption measurements. *Basic Life Sci* 1990;55:267-274.
7. Burger DE, Milder FL, Morsillo PR, Adams BB, Hu H. Automated bone lead analysis by k-x-ray fluorescence for the clinical environment. *Basic Life Sci* 1990;55:287-292.
8. Schidlovsky G, Jones KW, Burger DE, Milder FL, Hu H. Distribution of lead in human bone: II. Proton microprobe measurements. *Basic Life Sci* 1990;55:275-280.
9. Jones KW, Schidlovsky G, Burger DE, Milder FL, Hu H. Distribution of lead in human bone: III. Synchrotron x-ray microscope measurements. *Basic Life Sci* 1990;55:281-286.
10. Hu H, Milder FL, Burger DE. X-ray fluorescence measurements of lead burden in subjects with low-level community lead exposure. *Arch Environ Health* 1990;45:335-341.

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11. Hu H, Win KU, W, Arnison ND. Burma: Health and human rights. *Lancet* 1991;337:1335.
12. Hu H. A 50-year follow-up of childhood plumbism: hypertension, renal function, and hemoglobin levels among survivors. *Am J Dis Child* 1991;145:681-687.
13. Hu H. Knowledge of diagnosis and reproductive history among survivors of childhood plumbism. *Am J Publ Health* 1991;81:1070-1072.
14. Hu H, Milder FL, Burger DE. The use of K-X-Ray Fluorescence for measuring lead burden in epidemiological studies: high and low lead burdens and measurement uncertainty. *Environ Health Perspect* 1991;94:107-110.
15. Hu H, Pepper L, Goldman R. Effect of repeated occupational exposure to lead, cessation of exposure, and chelation on levels of lead in bone. *Am J Ind Med* 1991;20:723-735.
16. Hu H. Toxic weapons, epidemiology, and human rights. *Polit Politics and Life Sci* 1992;February:3-4.
17. Hu H, Sparrow D, Weiss S. Association of serum albumin with blood pressure in the Normative Aging Study. *Am J Epidemiol* 1992;136:1465-1473.
18. Hu H, Christiani D. Reactive airways dysfunction after exposure to tear gas. *Lancet* 1992;339:1535.
19. Hu H. Physicians, IPPNW, and the Environment. *PSR Quarterly* 1993;3:79-87.
20. White RF, Diamond R, Proctor S, Morey C, Hu H. Residual cognitive deficits 50 years after lead poisoning during childhood. *Br J Industr Med* 1993;50:613-622.
21. Hu H, Beckett L, Kelsey K, Christiani D. The left-sided predominance of asbestos-related pleural disease. *Am Rev Resp Dis* 1993;148:981-984.
22. Payton M, Hu H, Sparrow D, Young JB, Landsberg L, Weiss ST. Relation between blood lead and urinary biogenic amines in community-exposed men. *Am J Epidemiol* 1993;138:815-825.
23. Hu H, Kotha S. Ethics and epidemiology: International Guidelines. *Polit Life Sci* 1993;February:29-30.
24. Goldman RH, White R, Kales SN, Hu H. Lead poisoning from mobilization of bone stores during thyrotoxicosis. *Am J Industr Med* 1994;25:417-424.

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27. Hu, H. Decision-making in human health impact assessments: a clinician's perspective. *Environ Impact Assess Rev* 1994;14:439-450.
28. Hu H, Watanabe H, Payton M, Korrick S, Rotnitzky A. The relationship between bone lead and hemoglobin. *JAMA* 1994;272:1512-1517.
29. Payton M, Hu H, Sparrow D, Weiss ST. Low-level lead exposure and renal function in the Normative Aging Study. *Am J Epidemiol* 1994;140:821-829.
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31. Guo H-R, Chiang H-S, Hu H, Lipsitz SR, Monson RR. Arsenic in drinking water and urinary cancers: a preliminary report. *Environ Geochem Health* 1994;s16:119-128.
32. Hoppin JA, Aro ACA, Williams PL, Hu H, Ryan PB. Validation of K-xrf bone lead measurements in young adults. *Environ Health Perspect* 1995;103:78-83.
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34. Hu H, Aro A, Rotnitzky A. Bone lead measured by X-ray fluorescence: Epidemiological methods. *Environ Health Perspect* 1995;103(Suppl 1):105-110.
35. Kim R, Aro A, Rotnitzky A, Amarasiwadena C, Hu H. K x-ray fluorescence measurements of bone lead concentration: the analysis of low-level data. *Phys Med Biol* 1995;40:1475-1485.
36. Kim R, Hu H, Rotnitzky A, Bellinger D, Needleman H. A longitudinal study of chronic lead exposure and physical growth in Boston children. *Environ Health Perspect* 1995;103:952-957.
37. Hu H, Kotha S, Brennan T. The role of nutrition in mitigating environmental insults: policy and ethical issues. *Environ Health Perspect* 1995;103(Suppl 6):185-190.
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levels of lead. *Medicine Lavoro* 1995;86:229-235.

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42. Hu H, Aro A, Payton M, Korrick S, Sparrow D, Weiss ST, Rotnitzky A. The relationship of bone and blood lead to hypertension: The Normative Aging Study. *JAMA* 1996;275:1171-1176.
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